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Southern Rhodesia

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(Assisted by the Staff of the Division of Agriculture and Lands).

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Contents.

JANUARY-FEBRUARY, 1947.

Contents.

MARCH-APRIL, 1947.

Contents.

MAY-JUNE, 1947.

Contents.

JULY-AUGUST, 1947.

NOTICE.

HORSESICKNESS INOCULATION.

Horsesickness Inoculation. Vaccine for the inoculation of horses and mules of any age against horsesickness will be issued from now onwards until the end of November at a cost of 6s. per dose, post free.

Immunity dces not reach its height until some months after inoculation, and owners are therefore urged not to defer inoculation until the end of the season.

The vaccine must be used within seven (7) days of its despatch from the Laboratory, and will be issued direct to applicants, who will be required to do or arrange for the inoculation themselves.

Directions for use will be supplied with the vaccine.

Applications, in writing, and enclosing the cash remittance, should be made to The Director of Veterinary Research, P.O. Box 657, Salisbury.

Orders will be dealt with strictly in rotation and according to the supplies which may be available at the time.

Applications will neither be acknowledged nor considered unless they are accompanied by cash (6s. per dose) and received by the 30th November.

Horsesickness Vaccine.

Price: 6s. per dose.

Closing date for applications: 30th November.

Inoculate now.

Use within one week of its issue.

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Contents.

SEPTEMBER-OCTOBER, 1947.

Contents.

NOVEMBER-DECEMBER, 1947.

THE RHODESIA
Agricultural Journal

Vol. XLIV. No. 1 January-February, 1947.

Editorial

Notes and Comments

RETIREMENT OF MR. C. L. ROBERTSON, O.B.E., SECRETARY, DEPARTMENT OF AGRICULTURE & LANDS.

On the 15th February the staff of the Division of Agriculture and Lands bid an official farewell to Mr. C. L. Robertson, O.B.E., the retiring Secretary of Agriculture and Lands.

Warm tributes to his work were paid by the Hon. P. B. Fletcher, Minister of Agriculture, Capt. the Hon. F. E. Harris, former Minister of Agriculture, and Dr. E. Romyn, the new Secretary, Department of Agriculture and Lands.

Mr. Robertson first joined the Service in 1914 as Assistant Agricultural Engineer. After some two years, he proceeded on active service with the Royal Engineers and served in Mesopotamia and India.

When he returned in 1920 he was appointed Hydrographic Engineer, whose duties included that of Meteorologist. In the meanwhile the Irrigation Branch continued to expand, and in 1934 he took charge of it. In 1942 the Irrigation Branch became a Department and he was appointed Director of Irrigation. While with the Irrigation Department, Mr. Robertson was responsible for a number of major projects, such as the Umshandige and Umgusa Dams, and was also largely responsible for the Water Act, which is considered a model of its kind.

During most of this time he was closely associated with the organisation of the Public Service. He served on the Executive of the Protec. For many years he was a member of the Public Services Board, and for a period acted as Chairman of the Board.

He was appointed Secretary for Agriculture and Lands in 1943. He retired officially on the 14th January last, but has since then been called upon to assist the Colony in a number of fields:—Electricity Supply Commission, Sugar Board, and now Chairman of the National Drought Committee.

Seldom has the Head of a Division been held in such general esteem and affection as C. L. Robertson by his Department, the farmers and the general business community. In this respect one

must mention also Mrs. C. L. Robertson, who worked untiringly in the same fields from the feminine side, and during the latter war years headed the very extensive war effort of the women associated with the Department.

We wish him every happiness in his retirement from this post and all good wishes in his new appointment as Chairman of the National Drought Committee.

PEA VINE RESIDUE: VALUABLE STOCK FEED.

America has long recognised the high feeding value of pea vine residue (the remains of green pea vines which have passed through a vining machine). This residue consists of vines and empty pods, or, in the case of frosted crops unfit for canning, vines and full pods. It is a valuable feed for all types of stock—milking cattle, beef cattle calves, breeding ewes, fattening lambs, horses, pigs and poultry. In New South Wales, also, an increasing number of farmers are appreciating its value.

The pea vine residue contains 12% protein (lucerne contains 15%) and it is high in Vitamin A, Calcium and Riboflavin (essential for high hatchability in poultry).

Silage made from the material should be fed immediately after milking rather than before in case of tainting the milk. About 3 lbs. of this silage is equivalent to 1 lb. lucerne hay.

In New South Wales there are five methods of handling the residue, i.e., Stock Silage, Pit Silage, Tub Silage, Green Feed, and Loose or Baled Hay. It is believed that Dehydration could no doubt be used successfully on a limited scale.

A chemical analysis of three samples of hay are as follows:—

	Moisture %	Protein %
From the Viner	9.2	9.5
From hand-picked Vines	9.1	10.4
From frosted Vines	8.8	12.4
Lucerne	10.0	15.0

The following is an analysis of poultry foods in leaf meal form—

	Protein %	Crude Fibre %
Lucerne	20.2	24.8
Pea Vine	17.2	16.5
Turnip	26.2	7.6

—("N.S.W. Agricultural Gazette," October, 1946.)

USE OF GROWTH-PROMOTING SUBSTANCES FOR WEED CONTROL IN SPORTS TURF.

Experiments carried out in the autumn of 1946 by the Board of Greenkeeping Research, St. Ives Research Station, Bingley, with "Methoxone" and "2 : 4D" on well-established perennial weeds in a turf sward gave such promising results that it would appear that the use of these two substances will open up quite a new approach to turf weed problem.

A replicated random block technique was used for the experiments. New experiments were commenced at frequent intervals throughout the year and different rates and methods of application were employed. Large-scale trials were done with "Methoxone," but unfortunately lack of adequate supplies of "2 : 4D" prevented large-scale trials with this substance.

It was found that the application of "Methoxone" at the rate of 6 lbs. per acre, as spray or powder, afforded practically complete control of common turf weeds, e.g., broad-leaved plantain (*Plantago major*), ribwort plantain (*P. lanceolata*), buck's horn plantain or starweed (*P. coronopus*), self heal (*Prunella vulgaris*), creeping butter-cup (*Ranunculens repens*), and cat's ear (*Hypochoeris radicata*).

When application of "Methoxone" was preceded by a dressing of nitrogenous fertiliser, e.g., sulphate of ammonia, then control was speedier and also the filling in of the grass after the weeds was encouraged.

A summary of results obtained from an experiment on a cricket ground is given in the following table:—

Treatment.	Percentage Area covered by "main weeds."		control. Per cent.
	Before Treatment.	After Treatment.	
Control	25.8	26.2	—
6lbs. "Methoxone" per acre as spray	25.8	2.6	—
6lbs. "Methoxone" per acre as powder	33.5	5.6	83.3
6lbs. "2 : 4D" per acre as spray	43.0	3.4	92.1
6lbs. "2 : 4D" per acre as powder	35.2	0.7	98.0

Effective control was measured six weeks after treatment. The plots were given a pre-application of nitro chalk seven days in advance of the "Methoxone." The main weeds were Daisy (*Bellis perennis*), Dandelion (*Taraxacum* sp.), Clover (*Trifolium repens*), Plantain (broad-leaved and rib-wort) and selfheal.

Heavy rain falling after application of "Methoxone" or "2 : 4D" is likely to nullify its effects.

Experiments show some differences between the two chemicals as regards persistency and in their effects on germination and growth of grass seeds.—("Nature," Vol 23, 1946.)

BROOM CORN MILLET—DANGER IN GRAZING.

A note appears in the New Zealand "Journal of Agriculture," September, 1946, warning farmers who wish to sow millet for graz-

ing to be sure they buy the seed of the Japanese millet (*Echinochloa crus galli*) and not the seed of the broom corn millet (*Panicum miliacium*), which is usually sold only for bird seed and should on no account be sown for grazing.

In New Zealand sheep often contract facial eczema in the autumn when grazing on pastures, and in order to find a crop on which a large number of sheep could be grazed safely during this period, a series of crops were grown on the New Zealand Department of Agriculture's farm in the Gisborne district. It was found that Japanese millet was successful. A neighbouring farmer, unable to get Japanese millet, planted broom corn millet and grew what appeared to be a valuable stand of green fodder. On February 4th, when the millet was 8 ins. to 1 ft. high, 500 lambs were turned on to the crop. By February 8th a large number had symptoms similar to facial eczema, which eventually resulted in the death of 100. Experiments showed that the crop remained toxic up to the seeding stage.

The broom corn millet was found to remain toxic after drying. The leaves were to be tested for the toxic principle.

FRUIT SETTING SPRAYS FOR TOMATOES.

In the Journal of the Ministry of Agriculture for September, 1946, an interesting account is given of experiments carried out with beta naphthoxy-acetic acid (BNOA) in connection with fruit setting.

It was found that at concentrations of 40 to 60 parts per million no damage was done to the plant and that as a result of the spray, well filled, good quality fruits were produced.

When testing out these new compounds the natural pollination of the flower is checked by removing the stamens and cutting the style before flower bud opens. The compound is then mixed with lanolin to form a paste and is smeared over the ovary. The fruit which develops will be seedless. On a commercial scale the substance is made up to necessary strength and sprayed on the open flower.

Spraying is best carried out from two days before the bud opens to three weeks after petal fall and one spray should be sufficient. This treatment with a growth substance is merely an emergency measure when natural pollination is insufficient.

Most members of the tomato family and cucumber family respond to BNOA treatment.

Good results have also been obtained with strawberries, raspberries and blackberries. No substitute for natural pollination has been found for apples, pears, cherries, plums and peaches.

It is also interesting to note that this treatment does not appreciably affect acidity, vitamin content, quality or flavour of the fruit.

The Boltt Dairy Boiler.

(DEFECTS IN CONSTRUCTION)

By the DAIRY BRANCH.

When the details of the Boltt dairy boiler were first published in the "Rhodesia Agricultural Journal" and later in bulletin form, no mention was made of the method to be employed in securing the boiler tubes inside the petrol drum.

This type of boiler is becoming very popular amongst dairy farmers, and, where it has been constructed on the right lines, is giving entire satisfaction.

However, a small number of these boilers have been sent to Salisbury, after only a month or two's use, in such a bad state of repair that it is feared unless some mention is made of how the tubes are to be fitted, this type of sterilising combination may lose its reputation and probably disappear from use.

All the boilers referred to above were defective on account of the tubes being brazed and not welded into position. Brass expands far more rapidly than the steel from which the petrol drum is made. Hence, under the extreme heat conditions encountered in the boiler, the brass expands to such an extent as to tear the sides of the drum away from the tubes, thus causing leaks.

The secret, if there is a secret, lies in the fact that the tubes in this boiler should be welded with mild steel rods and not brass.

Mild steel expands under conditions of heat at the same rate as the drum, so that the risk of the drum and tubes parting is avoided.

There is nothing wrong with the design of the Boltt Dairy Boiler. It is efficient, reasonably cheap to operate, and, as the original made by Mr. Boltt is still in daily use, the claim can justly be made that it will last several years if it is properly constructed.

Before having a Boltt boiler built, it is advisable to study carefully the details of construction as outlined in Bulletin 1361.

Pitsawing.

By E. J. KELLY EDWARDS, M.A., Dip. For. (Oxon.),
Conservator of Forests.

(Reprint of Bulletin No. 1190 of 1941, now out of print.)

At the present time when squared timbers are both costly and difficult to obtain the ancient but extremely serviceable method of ripping wood with the pit saw is well worth consideration.

In the hands of expert sawyers the pit saw can achieve work of great accuracy, so that in most cases no re-sawing is required to obtain squared timber of the required dimensions, but to those who are in possession of mechanically driven circular saws of low power the pit saw is very useful in the preliminary breaking down of large logs.

The following article does not pretend to give an exhaustive account of pit sawing. Expert pit sawyers have various labour-saving devices and "gadgets," but the article gives the main essentials which will enable even the novice to train two intelligent labourers to carry out what is really a very simple and cheap operation. If trained pit saw boys are available they should be engaged on the best terms possible, as they are worth it. If none are available all that is required is a few days' patience to give the necessary training. Training should start on a poor quality log, and not on the special log which has been held until a suitable opportunity presented itself to saw it for a special piece of furniture.

In brief, pit-sawing requires two operators—guide and sawyer—a specially designed rip saw, a pit (or platform) of sufficient depth to allow the sawyer to stand comfortably upright, two or three transverse movable logs of equal dimensions to carry the log to be sawn and wedges or clamps to hold the log in position.

THE SAW.

Fig. 1 shows two pit saws with 6 feet blades. The broader top portion of the blade carries the handle used by the guide. The lower tapered portion is provided with a double grip with a slit to envelop part of the blade, to which it is attached either by means of a wooden wedge or by a pair of bolts. The grip is readily detachable to allow the saw to be taken out of the saw cut.

At the present time a 7 feet rip saw costs about £4, and apart from the small cost of a saw set and files, and, of course, the labour employed in digging the pit and operating the saw, this is the sole outlay.

It is highly important that the saw should be correctly set and sharpened before use, and that setting should take place before sharpening. The saw teeth should be "spring set," i.e., the teeth are bent right and left alternately exactly the same amount on both sides. The amount of set to be given must be determined by practice and will largely depend on the type of wood to be sawn—the wider the set the more exertion required and the greater the

"kerf" and waste of wood. If the teeth are set exactly equal on both sides the saw may be worked with less set than if the teeth are irregular. Generally the set should start from about one-third of the way down the tooth and should never start at the root of the tooth.

In sharpening the saw, avoid files with sharp corners; hold the file level and at right angles to the blade so that the tooth is filed square across the face.

THE PIT.

An average pit (Fig. 2) would be about 10 feet long by 3 feet 6 inches wide and 5 feet 6 inches in depth, due allowance being made for the fact that the log to be sawn will be higher than the top of the pit by the amount of the diameter of the transverse bearers.

MARKING THE LOG.

The log to be sawn is first barked, crosscut at both ends and then placed on the transverse bearers in such a position as to obtain from it a square or rectangular baulk of greatest dimensions if squared timbers are required, or, if planks of a certain thickness are wanted, in such a position that the greatest number as wide as possible can be obtained.

The log shown in Fig. 5 was intended to produce 3in. x 2in. material.

A nursery or mason's line is now soaked in a mixture of ground charcoal and water and is drawn taut along the length of the log so as to give one of the lines shown on the log in Fig. 4. The tautened line is then pulled up in the middle and released to leave the black mark shown. The same line (or a shorter) with a plumb-bob attached is then used at both ends to give corresponding marks across the cross-cut faces. From these lines the required width of the baulk is set off at right angles at both ends, making due allowance for the kerf of the saw. The plumb is then placed so as to fall through the marks so obtained, and the vertical lines are struck as before. The two ends are then joined by the charcoal line, which is tautened and released to give the second mark shown in Fig. 4.

The whole log is then turned over through 180 degrees and corresponding marks made along the original underside of the log by joining up through the vertical lines previously obtained.

Instead of a plumb-bob a builder's level can be used for the vertical lines, and in the case of a log which is to be sawn to produce planks of a given thickness but any width, all the marks are made beforehand.

SAWING.

The log is now set firmly on two transverse bearers and is kept in position (after ensuring that the vertical marks are truly plumb) by means of wedges, as shown in Fig. 3, or longitudinally placed poles (Fig. 5), or by a series of spikes. The spikes may be made by bending over at right angles a bar of iron three feet in length nine inches from each end and pointing the ends. One end of the clamping spike is driven into the transverse bearer and the other into the log. Spikes are particularly useful with logs of small diameters or sawn material of small dimensions.

The operators then take up their positions as shown in Figs. 5, 6 and 7 and the first cut is made by a series of short strokes until there is a sufficient depth of cut to ensure that the saw is working in the correct plane. The functions of the top operator—the guide—are to raise the saw from the downward stroke, to see that the saw works in one plane and to ensure that it holds to the line. *He does not saw nor push down the saw.* That is the function of the sawyer below who performs the actual ripping stroke. This is a steady out-down-in pull somewhat reminiscent of the action of a man sculling a boat standing and facing the direction nof the boat's progress. The action of the two operators is not a continuous up-and-down motion. The guide pulls up the saw and there is a pause, the sawyer sweeps the saw down, at the same time following his line on the under-side of the log, and there is another pause, followed by the upward and backward pull of the guide. The latter often provides himself with a horse-tail switch with which he brushes aside the saw-dust which tends to collect and obscure the marked line. This he performs with a neat flick in the momentary pause which follows the downward stroke.

The cut on the first line proceeds for a few feet, e.g., to the guide's right foot in Fig. 5. The saw is then withdrawn and a fresh cut started on the next line until it reaches the same distance as the first cut. This operation is repeated until all the cuts have reached this length, when the first cut is continued another stage, and so on until all the cuts are near the end of the log, when the flitches or planks should be sawn completely through. It is a mistake to endeavour to turn the log end-for-end, start at the other end and to try to make the cuts meet in the middle. From time to time the front transverse bearer is moved backwards or forwards to ensure that the saw has full play and that the log is being supported to the best advantage.

The log shown in Figs. 3 and 4 was squared on two sides and then turned with one square face down as shown in Fig. 5. The log was then marked with the charcoal line to give 2-inch widths and sawing proceeded as with the original log.

In sawing logs which are destined to give, say, inch thick material for furniture, or eucalypt logs which are inclined to warp, it will be found best to saw to required depth only in the first instance and not to edge the planks until they have seasoned. Where the completed article is required to have exact dimensions allowance should be made for shrinkage and final planing.

SEASONING.

It is well in all cases to stack the sawn material for seasoning. The pile may be in an open shed or under outside shade well exposed to the air. The pile should be raised on suitable foundations at least a foot above ground level. "Stickers" of squared material ¾in. to 1½in. should be placed at regular intervals of about 18ins., *vide* Fig. 8. Heavy logs or stones should be placed on top of the stack to give weight, and the top should be covered with any material which will keep off the rain and sun.

Material such as 3in. x 2in., 4½in. x 1½in., etc., is best cross-piled, i.e., one layer is placed on the foundations with the planks 18ins. apart, and the next layer placed on top at right angles with the same 18in. intervals, and so on. No "stickers" are used.

Fig. 1.—Types of Pitsaw.

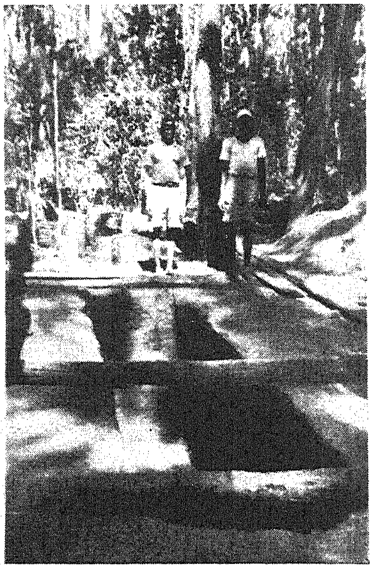

Fig. 2.—Pit with transverse bearers.

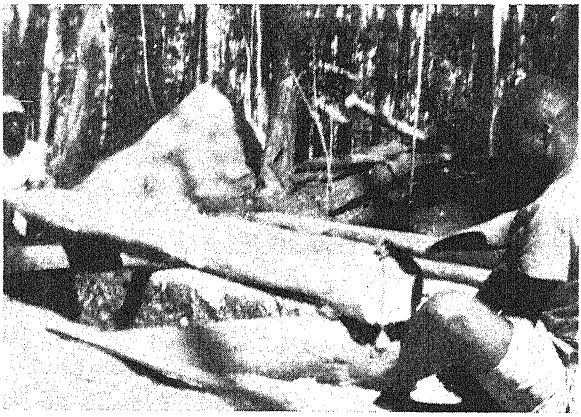

Fig. 3.—Marking vertical line by use of plumb-bob.

Fig. 4.—Marking the longitudinal lines.

Fig. 5.—Baulk being finally squared. Note switch in guide's hand and method of gripping handle.

Fig. 6.—Temporary platform to show position of sawyer.

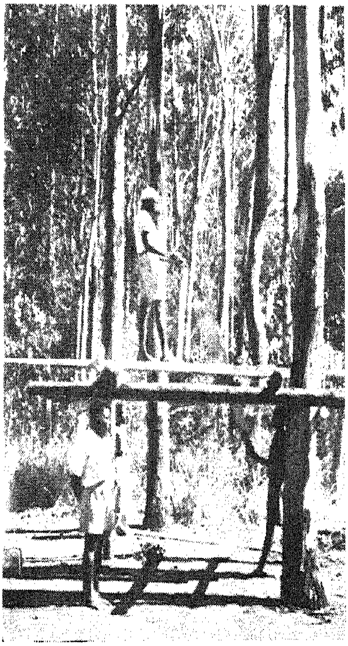

Fig. 7.—Temporary platform to show positions of guide and sawyer.

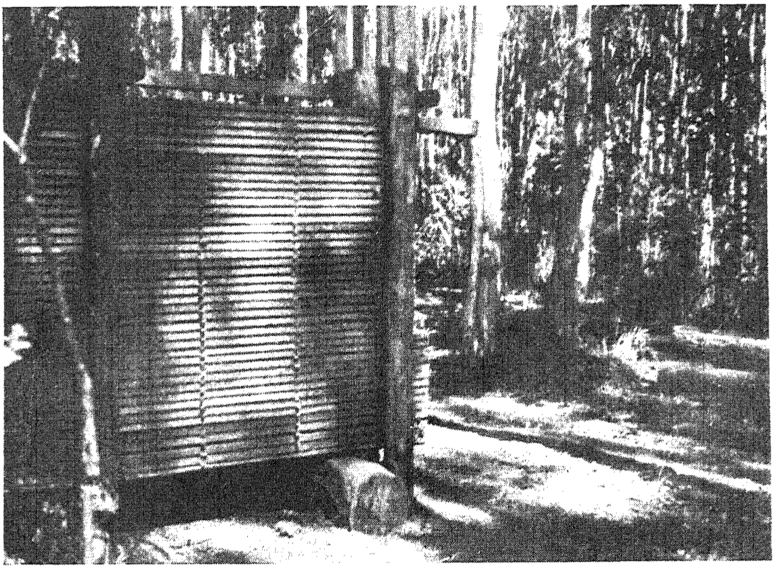

Fig. 8.—Inch boards stacked for seasoning. Note foundation log. Foundations should be about two feet apart.

The Pot Planting of Eucalypts.

By Major G. R. WAKE, Vigila, Umvukwes.

[This is a reprint of Bulletin 1085, which is now out of print.—Editor.]

This article refers to eucalypt planting in the Umvukwe district in north-central Mashonaland, the soil being mainly a sandy loam, the average rainfall 35 inches and the altitude about 4,800 feet, roughly the same as Salisbury. Naturally, the problem of eucalypt planting varies according to the rainfall. Though 35 inches is ample enough if more or less evenly distributed throughout the year, as in the Eastern Districts, or if it is accompanied by "guti" or mist during the dry period as in the Midlands; its value is greatly decreased when, as in the Umvukwes, it all comes down in five months, ending abruptly in March or April, and is followed by a dry period of six months or more, sometimes without even a shower.

When the greater part of this tobacco district was opened up in 1925 and 1926, farmers were not long in realising that the countryside would be rapidly denuded of timber for fuel purposes, and efforts were soon made to plant eucalypts, but the results were most disappointing.

The "open root" system, understood to be entirely successful in the Eastern Districts, was employed, but the problem was greatly complicated by the necessity of using all the labour on dull or wet days for planting out tobacco. Eucalypt planting was put off, and if no convenient opportunity occurred, was abandoned. Not much planting was done and the "stands" were usually very poor.

Some three years ago the Nyasaland pot planting method, as opposed to open root planting, was generally adopted. It is no exaggeration to say that the area under eucalypts all planted during the last three rainy seasons fully equals the area planted in the previous ten years.

It is here necessary to point out that the method of pricking out seedlings in petrol tins cut in half lengthways, as adopted by the Government nurseries, is not feasible in this district, for the very obvious reason that petrol is now obtained from pumps by those farmers living near a store, or is bought in drums to save expense. Such petrol or paraffin tins as find their way to a tobacco farm are of great value for carrying water to tobacco seed-beds, and are kept for this purpose. Nor can boxes be made owing to the high cost of timber. Moreover, if tins are used, the soil used must be a special mixture of antheap or clay, and great care must be taken when planting seedlings in the field, failing which the lateral roots will be disturbed and the plant die. This danger is

eliminated when pots are used, and no skill is required to obtain a perfect "stand."

The Nyasaland pot is a cylinder made of "dagga" as used for slop bricks, about 6 inches long with an interior diameter of 2½ inches, and with no bottom. These are burnt sufficiently to be handled with ordinary care without breaking. The eucalypt seedlings are pricked out in the pots, which are filled with ordinary sandy top soil, and when about six inches high the pots are cracked in several places and the eucalypt, pot and all, is planted out in the field. The lateral roots work their way through the cracks, and if the latter are large enough, the plant makes a satisfactory growth.

Some farmers broadcast the seed over the pots when filled with soil, and then thin out surplus seedlings. Apart from the obvious waste of seed, the writer has found that this method was actually longer and more expensive than pricking out, because the labour of watering a large area of pots lasted twice as long. Attending for half the time to a very small area of seed-bed where thousands of seedlings can be grown is not an expensive matter.

One "boy" can prick out hundreds of seedlings in a day, and the only care necessary is to avoid exposing the roots to the sun. To avoid losses in this way, the seedlings are put at once into a can of water as soon as pulled from the seed-beds, and then conveyed to the pots.

In order to avoid as much transport as possible, it is advisable to have the pot nursery close to or on the site of the proposed plantation, provided, of course, that water is available. If the plantation is near water, the pots can be taken direct from the kiln to the nursery several hundred in one wagon load. When the time for planting out comes, they can be taken to the field in a wheel-barrow, or carried by hand, whichever is most convenient. The Nyasaland method of pot construction is admittedly clumsy and wasteful. It necessitates the complete destruction of all the pots every season. In addition, there is always the danger of the check to the growth of the plant in the field, or its loss, if the pots are not suitably cracked and the lateral roots fail to break through.

The writer, who in pre-war days has watched hundreds of geraniums being bedded out, and their pots being used again and again, has very successfully used a cone-shaped pot, from which the eucalypt is removed without the soil being disturbed, and the pot used again. When the seedling is six to eight inches high, it becomes sufficiently root-bound to allow of its removal from the pot without any soil breaking away. Ordinary sandy loam from a vlei is used, and the plant well watered before removal. The sides of the pot are gently tapped and the plant is pushed out from the bottom.

The size of the cone-shaped pot is 5½ inches high, and its internal diameter is 3½ inches at the top and 2 inches at the base. The pot has no bottom.

The pot mould is easily made by cutting out a piece of paper the internal dimensions of the pot and placing it flat on a half-inch plank made of ceiling boards, or the top of a petrol box. This piece

is cut out and the mould is now put on a plank covered with a piece of cloth (Fig. 1). The mould is filled in the ordinary way with dagga made from two parts anthill to one part sand. The mould is lifted off and the dagga, which is the correct dimension of the

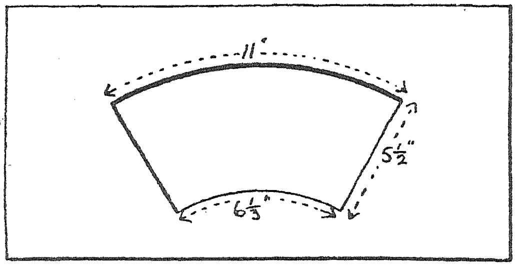

Fig. 1.

pot, is wrapped round a block of wood the interior size and shape of the pot. The cloth is peeled off, and the side sealed with the fingers. The pot is then slipped off the block and put out to dry (Fig. 2). The dagga should be made stiff enough to handle, but

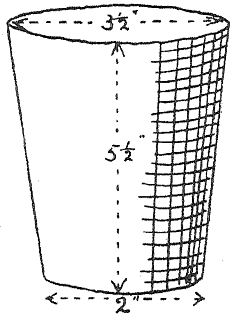

Fig. 2.

no difficulty has been found here. After drying in the sun, the pots are placed on their sides in layers two or three pots deep in a trench, the bottom of which is filled with a layer of wood or mealie cobs. Alternate layers of wood and pots are put in the trench until it is filled. The most convenient size of the trench is 5 or 6 feet wide and 3 to 4 feet deep, and any length required. A fire is lit at one end and in 24 hours all the fuel is consumed and the pots properly burnt. They should become red-hot for this purpose. The writer has found that this method of planting eucalypts, which can be done on a hot day when tobacco planting is not possible, is by far the most economical in time and labour, and if done early on in the season to allow the eucalypts to get established, losses due to bad planting are nil.

The making of this improved type of pot is not costly. One man to mix the dagga and two men with moulds can, with a little practice, turn out 500 to 600 pots in a day, which should last for years.

NOTE BY THE DIVISION OF FORESTRY.

The need for augmenting indigenous timber supplies in many tobacco growing areas is of such importance that tree-planting should be considered as an integral part of farming operations, and requiring its due measure of care and attention.

Any planting method which is economical and ensures a satisfactory establishment is to be commended. In areas of favourable rainfall the planting of open-rooted seedlings direct from nursery beds can be carried out successfully at small cost if it is done during dull or rainy weather, and provided proper care is taken (a) in lifting the plants in such a way as to cause the minimum of damage to the roots, and (b) transporting the plants in a sloppy mixture to ensure that the roots are exposed to the air for as short a time as possible. Carelessness in these respects usually means that the plants are dead before being planted out in their permanent sites.

Ball-planting of transplants from tins or trays (usually 25 to 30 transplants per half petrol tin or similar receptacle) is generally a safer method, especially with such trees as *Eucalyptus maculata*, E. *citriodora*, *Callitris calcarata*, C. *glauca Pinus longifolia* and P. *canariensis*, because the roots are contained in a ball or cube of earth and thereby suffer little disturbance or exposure.

Pot planting is merely a modification of ball-planting, but it means that each tree is treated more as an individual, so that there is a tendency for planting to be more costly, particularly in the matter of transport from nursery to planting site.

For those tree growers who are unable to exercise adequate supervision of open-rooted plantings or who cannot obtain tins or trays for ball-planting, it is probable that pot planting is most likely to ensure a successful stand of trees.

Summary of the Twenty-Sixth Annual Report of the Division of Forestry.

FOR THE YEAR 1945.

By E. J. KELLY EDWARDS, M.A., Dip. For. (Oxon.),
Conservator of Forests.

The main feature of the year was the acquisition by the Government of two areas in the Melsetter District for State afforestation.

These areas are two compact blocks now known as the Martin Forest Reserve and the Tarka Forest Reserve, respectively 25,071 acres and 10,730 acres in extent. Of the total area, it is estimated that at least 20,000 acres are afforestable with exotic pines, cypresses and other softwoods.

With Stapleford and a part of the Rhodes Inyanga Estate already reserved for forestry, it means that in the high rainfall zone of the Eastern Districts the State now has about 43,000 acres dedicated to afforestation with softwoods.

Of this total area only 5,730 acres are at present afforested, and this represents mainly pre-war plantings, as the programme of 700 acres per annum at Stapleford was drastically curtailed to the extent that for the six years from 1939 only 1,046 acres out of the 4,200 acres projected were planted.

With an average rotation of 30 years, it means that the remaining 37,300 acres must be planted at the rate of 1,250 acres a year, but it will not be possible, through lack of staff, to achieve this programme for at least two years, by which time an accelerated programme will be necessary to make up the shortfall, so that it is envisaged that by 1948 a minimum annual programme of 1,300 acres will be required.

On account of the nature of forestry operations and to allow for contingencies such as adverse climatic conditions, diseases, insect pests, financial depression and so forth, it is wise not to adhere to a minimum theoretical acreage but to plant at more than the prescribed rate during the first half of the rotation.

The average annual consumption of softwoods in the Colony for the five years preceding the war was in the neighbourhood of 1,200,000 cubic feet, wrich represents some 3,000,000 cubic feet of log timber.

If the 43,000 acres now to be devoted to softwoods are fully planted within the next 30 years, they should be capable at that

time of producing 10,000,000 cubic feet of log timber, i.e., about three times our present requirements. This would mean an increased consumption of about 7½ per cent. per annum as against the average pre-war rate of 5 per cent.

With present indications, we are justified in assuming that progress in the Colony should allow for at least a 10 per cent. increase in the annual consumption of softwoods, and it is therefore necessary that provision should be made within the next ten years for an annual planting of 2,000 acres, and also for the acquisition of more land for afforestation.

The contemplated post-war expansion is not only confined to afforestation with softwoods. The management of indigenous forests is already playing a large part in the Division's activities, but so far it is concerned only with the Rhodesian "teak" forests of Matabeleland. Other types of native forest can be made equally productive as well as serving a most important function in the conservation of soil and moisture.

The Division is equipped with the necessary experience to undertake the exhaustive preliminary surveys which are necessary prior to establishing new forest areas, but it is severely handicapped by lack of trained staff.

It is therefore gratifying that complete approval was given to a scheme to open a Temporary School of Forestry designed for the dual purpose of turning out 20 trained foresters within the next two years and of providing a career to young ex-servicemen as part of the general post-war rehabilitation programme. Training facilities have also been offered to and accepted by neighbouring Governments and private bodies engaged in forestry, with the result that when the School opens in March of this year a total of 32 men will be under full-time theoretical and practical instruction.

A significant indication of the possiblities of the Eastern Districts was forthcoming during the year by the launching of a large wattle-growing project in the Melsetter and Inyanga Districts by private enterprise with great experience in wattle and tannins generally in the Union and elsewhere. It is understood that the object is to grow sufficient wattle to justify at least two tannin extract factories within the next ten years. While the company will itself grow a large portion of its own requirements, there will be ample justification for farmers and others in the neighbourhood to undertake the culture of wattle with the prospect of an assured market.

During the year the long delayed drafting of a comprehensive Forest Bill was completed, and it is hoped that it will be published shortly for general information prior to being considered by Parliament.

In the course of the year the farm Molecomb (5,799 acres) was provisionally reserved for the indigenous forest estate. Including this farm, the total area of indigenous forest under the control of this Division now amounts to 1,123,417 acres, while plantations of exotic trees, including 83 acres planted during the year, total 8,715 acres, of which 7,014 acres are of conifers and 1,701 acres of broad-leaved trees.

Revenue for the year amounted to £36,191 and expenditure to £40,864.

Stapleford Forest Reserve. Exceptional frosts were experienced during June and July and resulted in considerable leaf fall from *Pinus radiata* stands affected by *Diplodia* and *Lophodermium*. With the advent of warmer weather, however, there was a marked improvement in all the stands, and it is pleasing to record that the plantations generally are now nearer to a normal state of health than at any time in the last three years.

The programme laid down in 1942 to bring all overdue thinnings and prunings up to date within four years has been achieved, and with 844 acres and 1,375 acres respectively treated during the past year, it is now possible to carry out the operations prescribed by the provisional working plan when they become due.

Good progress was made in compiling this plan, and it is hoped that it will be completed during the present year.

No new plantings were undertaken during the year through shortage of staff, but preparations are now under way to resume planting at a rate of 700 acres per annum.

The sawmill again had a successful year, with an increased intake and output amounting to 133,280 cubic feet and 38,590 cubic feet respectively.

It was still not possible to start the new mill intended primarily for box shooks on account of the non-arrival of electric power, although all the necessary plant and equipment were available.

As a result, timber available from thinnings was sold to private sawmills and others, and in this way 118,370 cubic feet of logs were accounted for.

Towards the close of the year steps were taken towards the erection of an up-to-date seasoning kiln. When this is in operation shortly, it will serve the double purpose of enhancing the quality of the timber produced and of giving the Department valuable data on the seasoning properties of local woods.

Revenue for the year showed an increase of £7,103 over 1944, and amounted to £16,878, as against an expenditure of £7,419.

At the end of the year Mr. R. H. Finlay resigned from the service to take up an appointment with a private company. While his loss will be keenly felt by the Service, there is satisfaction in knowing that his energies will still be devoted to furthering forestry in the Colony as a whole.

Mtao Forest Reserve. This Reserve again had a very busy year, and in spite of further depleted staff, it disposed of 96,960 cubic feet of timber, partly from thinnings and partly from clear fellings in eucalypt plantations which had been heavily cutover for war-time requirements. Certain low productive conifer stands were also stumped. During the war this station supplied over 475,000 cubic feet of poles, mainly from hardwoods.

The creosoting plant operated on 190 days and was responsible for treating 12,630 poles, of which 2,330 were large transmission poles from private sources treated on behalf of the Electricity Supply Commission.

The thinning and pruning programme in pine plantations is now up to date, with the exception of certain areas which have been especially reserved for instructional purposes for the new School of Forestry.

For the first time in its history of 23 years this Station experienced a very severe hailstorm in the middle of November. Its severity may be judged by the fact that hail was still lying in the plantations 24 hours later. Unfortunately, the path of the storm was directly over the main *Pinus radiata* plantations, and so far nearly 500 acres are showing the immediate effects of the damage. The storm was accompanied by high wind which caused numerous breakages in adjoining eucalypt areas. The ultimate effect of the damage remains to be seen, but at this stage an infection of *Diplodia* fungus is suspected.

During the year plantings showed a nett increase of 35 acres of conifers and 48 acres of eucalypts, and the total area now amounts to 2,646 acres, of which 1,279 acres are softwoods.

Revenue of £11,103 was the highest recorded for this Reserve, while expenditure amounted to £7,716.

Kalahari Sand Forests. The climatic condition in the Rhodesian "teak" areas were extremely severe, particularly as regards the very heavy frosts which were characteristic of the greater part of the Colony in mid-winter. Large areas in the forest proper were affected up to a height of 15 feet, and, but for the absence of charring, such areas appeared at first glance to have been burnt over. The fire hazard in an already dry year was thereby increased enormously, and unfortunately these areas are unable to show the comparatively clean sheets of previous years. Incendiarism in two of the protected areas caused severe fires, and in all 33 per cent. of the total forest area was traversed by fire and regeneration suffered accordingly. The only satisfaction was that the incendiaries were caught and convicted.

Lack of European supervision in five of the seven forest areas was partly responsible for the extent of these fires, and it reflects great credit on the existing staff of two men who endeavoured to control nearly a million acres requiring hundreds of miles of fire guards, that greater losses were not suffered.

Two sawmilling concerns continued exploitation operations in State forests under new agreements which came into force the previous year, as well as from other Government and private forests. Lack of equipment and skilled labour has prevented the completion of the new mill at Gwaai Siding, but it is anticipated that these difficulties will be overcome shortly.

It is estimated that the intake of log timber at these mills from Government forests amounted to 1,426,000 cubic feet during the year.

Revenue amounted to £4,534 and expenditure to £3,707.

Salisbury Forest Nursery. The Nursery was kept exceptionally busy in dealing with 2,700 visitors, and in raising 25 per cent. more forest transplants than in the previous year. But for the shortage of nursery trays—both wooden and tin—the output would have been still greater. Although an increased demand for plants had been allowed for, the prolonged wet spell at the end of the year, and the cessation of the war, resulted in more orders than anticipated, and all the requirements of the public could not be filled.

During the year steps were taken to concentrate more on the production of forest transplants than ornamental shrubs and trees, as it was considered this should be the main function of the Forest Nursery, and as private enterprise should be able to deal with a good part of the ornamental side.

The output of a nursery must be on some economic basis, as it is not possible to raise plants overnight nor to carry them over for an indefinite period. Prospective purchasers of large quantities would assist materially by placing their orders well in advance to save disappointment.

It is pleasing to note that sales of seeds have doubled during the past three years, which indicates a greater tendency on the part of the public to raise their own plants at a cost which must be appreciably lower than those purchased from a nursery.

Revenue for the year was £3,526, or £546 more than the previous year, while expenditure was £1,027, as against £976. This revenue was the highest recorded at this station.

Forestry in Native Reserves. The new system whereby forestry matters in Native Reserves were decentralised to District Forest Officers worked satisfactorily in Matabeleland and the Eastern Districts, but through acute shortage of staff and ill-health at Head Office, visits to Native Reserves in Mashonaland were extremely limited. In all, 21 visits were paid in Matabeleland and seven in the Eastern Districts, but only three in Mashonaland.

The training of 13 native Forest Rangers was continued at Mtao and Stapleford; of these, seven proved suitable for appointments. In addition, 10 local and 1 Swaziland trainees completed their training at Domboshawa, and were ready to proceed to Forest Reserves for further training by the end of the year. There are now 14 Rangers in various Native Reserves in the Colony.

A report was submitted on the possibilities of growing wattle in the Nyamaropa Reserve, which contains high land with high rainfall, but where occupation is limited by lack of trees. It is believed that wattle culture will remove this difficulty in a comparatively short time, and besides affording fuel, timber and shelter to an increased native population, it will furnish them with an appreciable outlet for wattle bark.

European Unemployment Relief in Forestry. The number of elderly men employed at the Chaka Nursery at Mtao dropped to five during the year. They were housed in the new camp, the old one being occupied by an average number of 47 Italian internees

who were provided with employment on general forestry operations in order to relieve congestion at the usual internment camps.

Game Reserves and National Parks (Wankie and Robins Game Reserves). Owing to the continued restriction of motor travel, there were only 290 visitors, and most of these were local residents.

Native Rangers patrolled the Reserve, and in doing so covered nearly 10,000 miles. Rangers are accompanied by Ranger Guides of the Bushman type.

Although the rainfall during the 1944/45 season was below normal, the rains fell mostly during January to March, with over an inch during May, and pans were well filled. All parts of the Reserve were well supplied, except the southern and eastern portions.

Windmills and crude oil engine pumps continued to play an important part in maintaining water supplies.

The engines pumped very satisfactorily, but at some of the areas it was as much as the engines could do pumping ten hours a day to replace the water which had been drunk by elephant and other game during the previous night.

On some occasions it was necessary to have the engines working during the night as well as during the day, when it was found that elephant took little notice of the noise but that other game were not so confident.

During the year a borehole was sunk in the Ngamo Vlei areas in the south-eastern portion of the Reserve, and permission was obtained from the railway authorities to close all cocks and stop some of the leaks in the dam they have abandoned on the Inyantue River.

The amount of game seen each month continues to show a steady rise, the peak period this year being in October, when the total seen reached 11 head per square mile, the highest average yet recorded since the recording of game seen was first started in 1937. Since that year the yearly average has increased from 1.6 head to 6.3 head per square mile for the year 1945.

An active campaign of vermin destruction under the supervision of the Game Warden was continued.

A European Vermin Ranger was appointed in June to replace the previous Ranger who was appointed, and resigned in 1944. This second Ranger was immediately replaced when he resigned in July.

Eight native Vermin Rangers were appointed in April and were stationed in the Gwanda, Plumtree, Shagani Reserve and Inyati areas.

A mobile unit in charge of the European Vermin Ranger commenced operations in June.

During the year 86 lions, 266 leopards, 69 hyena and 387 wild dogs were destroyed in the Colony, and of this total of 808 the

Vermin Destruction Unit destroyed 74. In addition, 47 wild dogs and a few hyenas and leopards were destroyed in the Wankie Game Reserve and for which no rewards were paid.

Rhodes Inyanga Estate. The Estate continued to serve a very useful purpose as a health and holiday resort, and the hotel and rest camps were well patronised. Considerable alterations and additions are being made to the hotel.

Trout fishing was satisfactory, and cards returned show that a total of 593 trout weighing 527 lbs. were caught. This information is, however, not necessarily complete, as catches are not always notified. A further 20,000 Rainbow Trout ova were obtained during the year.

Of the year's plantings of conifers a fair percentage survived the particularly severe winter and dry conditions which prevailed between May and October (6 months), when a total rainfall of only 2.97 inches was recorded. Approximately 120,000 seedlings of *Pinus patula* were raised for 1945/46 blankings and new plantings.

7,012 eucalypt and 274 pine poles were sold to the Department of Supply for £805 19s. 6d.

The potato crop totalled about 450 bags, of which 110 bags were kept for seed. Seed potatoes yield—sixth from imported seed—proved very satisfactory as regards quality but was a little disappointing in quantity.

Orchards are improving since their management has been taken over by the Estate, but full production cannot be expected for a year or two. An Orchards Manager was appointed during the year.

During the year the Estate disposed of 217 long tons of bark to the new wattle bark mill at Umtali for £1,254 1s. 1d. The quantity supplied was below what had been anticipated owing to shortage of labour and transport difficulties.

Private Forestry. Owing to shortage of staff itinerant advisory work was again restricted, although much time was devoted to advice by correspondence and interview.

Figures for 1945 private plantings are not yet available, but it is considered that satisfactory progress has been made.

Publications. During the year the following bulletins were published in the "Rhodesia Agricultural Journal":—

Bulletin No. 1313—"Forestry Notes for Conservation Officers," by E. J. Kelly Edwards.

Bulletin No. 1320—"Forestry Notes for Conservation Officers," by E. J. Kelly Edwards.

The writer records his appreciation of the good work and loyal co-operation of all members of the staff during the year.

Conservator of Forests.

18th February, 1946.

Preliminary Results in Improving the Sandveld Vleis on the Grassland Experimental Station, Marandellas.

By J. M. RATTRAY, Pasture Research Officer, and R. H. FITT, Animal Husbandry Officer.

Introduction. Vlei grasslands are a conspicuous feature of the granite country of Mashonaland, and on many farms occupy a quarter to a third of the total area. For this reason their agricultural potentialities have always aroused much speculation and discussion, and to this day there is still no satisfactory answer to the problem.

The vleis themselves vary considerably in both moisture content and soil type, but the main object underlying any attempted use of them has been to take advantage of the extra moisture present during the dry season for the production of winter crops. In the past natives cultivated them for rice, and more recently for vegetables, particularly the winter varieties. Most of the wheat produced in Rhodesia is grown on vleis, but this is gradually giving way to production on irrigated lands.

On the pastoral side their main use has been to provide late winter and early spring grazing. This is perhaps the most widespread method of utilisation, and again it is the extra moisture

PHOTO No. 1.
High-producing dairy cows on improved vleiland pasture on the Grassland Experiment Station, Marandellas. This pasture provides valuable grazing in autumn, winter and spring, and at these times of the year is much superior to the dryland or unimproved vlei pastures.

PHOTO No. 2.
Unimproved vleiland grazing on the Grassland Experiment Station, Marandellas. Note the dense cover of grasses and sedges. The herbage, however, is unpalatable and of little grazing value except in spring after burning. The dry-season carrying capacity is low as compared with the improved vlei pasture shown in Photo No. 1.

present which has been responsible for the development of this aspect. Unless the vleis are burned, however, the quality of the grazing is so poor and of such limited duration that some years ago it was decided to carry out a few preliminary investigations at the Grassland Experiment Station with a view to improving the pasturage by the establishment of higher-producing and more palatable grasses. The information contained in this article was derived from these investigations, and, it is hoped, may prove helpful to those farmers who are anxious to improve the grazing capacity of their vleis.

Types of Vlei. Vleis occur extensively throughout the Colony and at all elevations. They may be found typically in the bottoms and on the sides of shallow valleys, and owing to low grades, cooler aspect, and heavier rainfall are especially widely developed on the western catchment area of the Sabi River in the Marandellas, Charter and Gutu districts.

Soil. The soil is characteristically black in colour and varies in texture with the neighbouring rock formation, being gritty and sandy on granite and clayey on the greenstone schists or dolerite. The depth of this black soil may vary from a few inches to a few feet, and again it appears to be the nature of the neighbouring rock which determines this. As a general rule, top soils are shallow when the surrounding country is of granite origin and deeper where the adjacent formation is derived from schists or dolerite. In the granite areas these vlei soils are decidedly acid in their reaction.

Moisture. Owing to lack of drainage many vleis frequently become water-logged during the rainy season, but they may also become extremely dry during the winter, particularly if the summer rainfall has been low. On the other hand, the so-called "eyes" or springs from which many rivers arise usually remain wet and boggy throughout the year. For convenience, therefore, we may classify the vleis into three main types:—

1. Those which remain very wet throughout the year.

2. Vleis which are very wet in summer and the soil of which remains damp almost to the surface during the winter.

3. Vleis which are wet in summer and become very dry in the winter.

Vegetation. Two large families usually make up the entire population of the vleis, viz.: Grasses and sedges, and they contribute in varying proportions depending to a large extent on how wet they remain throughout the dry season. Thus in mid-summer after good rains have fallen and the plants have almost reached maximum growth, three distinctly coloured zones of vegetation become very conspicuous, particularly on the granite vleis. These areas consist of a bright, green central zone, a white zone adjacent to this, and an outer reddish-brown zone. The central green area derives its colour chiefly from sedges, although many grasses are present as well, and the soil is usually very wet, with free water on the surface. The white area is this colour on account of the abundance of Snowflake grass (*Andropogon eucomis*) and *Sporobolus subtilis*, one of the dropseed grasses, while the soil is damp and firm. The outer zone obtains its colour from the Russet grass (*Loudetia* sp.) and the soil is much drier than in either of

the other two zones. The Russet grass gradually disappears as the better drained dryland areas are approached.

In the damper parts of some vleis a tufted, wiry species of *Aristida*, usually known as "steek-gras" in Afrikaans owing to their objectionable seeds, is extremely common and is one of the most unpalatable constituents of the vegetation.

Grassland Experiment Station Vlei. The type of vlei on which the trials were conducted is representative of many of the vlei areas on the granite Sandveld of Mashonaland. During the rainy season a large proportion of it becomes very wet and may even carry one to two inches of free water on the surface for several months, while in the winter only a small area remains very wet, most of it is damp, and much of the rest becomes very dry with the water-table about three or four feet below. But the moisture conditions during the dry season appear to depend to a large extent on the amount of rain which falls in Summer and this makes for considerable variation from year to year.

The soil is black, gritty in texture, and the top soil shallow (only 4 ins. to 5 ins. in some parts) and overlies a white, fairly coarse sand so pure that it is useful for building purposes. The vegetal cover at the commencement of operations consisted of a wiry tufted species of Aristida (stick-grass) together with a number of sedges (or so-called water-grasses) in the wetter places and Russet grass and Thatching grass on the drier margins.

Selection of Area for Establishing Pastures. Areas which are permanently wet and spongy underfoot and constitute the actual "eyes" or springs in the vlei are not suitable for the purpose, as, apart from the difficulty of working them, they may even be a danger to stock owing to their boggy nature. In addition, however, it is felt that in the present state of our knowledge, these natural sources of water should be interfered with as little as possible and it is preferable to fence them off from the remainder of the vlei. One of these areas was planted to pasture but reverted back to the natural vegetation in 4 years.

The damp areas adjacent to these "eyes," however, have always proved highly satisfactory for planted pastures and have usually provided the most grazing.

Preparation of Soil. A preliminary ploughing of the area should be carried out in early autumn and a second ploughing in mid-winter (July). The object of the first ploughing is to turn the natural vegetation over in the sod so that the roots are exposed to sun and frost, thereby ensuring the death of the plants. By carrying out this process early a longer exposure is obtained before the second ploughing takes place, and the amount of re-growth which can develop is reduced considerably. At times, however, owing to the shallowness of the surface soil it is not possible to plough deeply enough to effect this without turning over the white, sandy sub-soil as well. In these cases it is necessary to burn or mow first so that shallow ploughing will still turn the sod over completely and not be hindered by the usually thick top-growth.

Two discings should follow before the rains, but the time at which these should be done depends on the type of grass which is to be planted. Discing was found to be preferable to drag-harrowing, as the latter process drags up pieces of plant to the surface,

thereby allowing them to re-establish themselves. This is particularly the case if the natural vegetation contains much Aristida or stick-grass. The surface of the soil is also left in a dirty state, which is not conducive to good, even stands when planting by seed.

Very little weed growth takes place during the winter, but as soon as the first rains fall in summer, weeds may often make an appearance in considerable numbers. (Among them is a tall purple-flowered legume (lesbania) which frequently forms fairly dense stands and may prove to have a certain value as a soil enricher. Cattle have been noticed browsing off it and it would appear to be worth investigating, as it seeds freely as well.) The grasses described in this article, however, seem to compete favourably with the weeds and make good progress in spite of them.

It may have been noticed that no mention has been made of rolling the surface and breaking the sods down to form a fine, smooth seed-bed. This was done during the first planting, but heavy rains after sowing the seed caused a great deal of wash and most of the seed was lost. By leaving the surface in a slightly rough condition (sods about the size of match-boxes) the wash was much reduced and consequent sowings came to little harm even after heavy downpours.

As far as possible ploughing should, of course, be done on the contour.

Grasses to Plant. A number of grasses and clovers have been tried out on the station, but the four which gave the most promising results were *Paspalum Urvillei* (upright paspalum), *Paspalum dilatatum* (paspalum grass), *Hemarthria altissima* (swamp couch) and *Acroceras macrum* (Nile grass). *Paspalum dilatatum* did not appear to stand up to the waterlogging conditions quite as well as the others, but made a good cover nevertheless. The other three grasses are apparently unaffected even when growing in water several inches deep throughout the rainy season and longer.

Seeding and Planting. *Paspalum Urvillei* and *Paspalum dilatatum* may be planted from seed, but it is advisable to use 2-to-3-year-old seed which has been tested for germination to determine the rate of sowing, otherwise extremely poor stands may be obtained.

Six pounds of good seed to the acre gives a satisfactory rate of sowing and should be carried out during the first rains. Earlier sowings may be unfortunate enough to suffer droughty conditions and many young seedlings will be lost.

Rhodes grass sown with the paspalum at the rate of 4 lbs. per acre has been found useful as a protection and cover to the young paspalum seedlings, as the latter are slower in developing and do not appear to mind the semi-shade conditions. Other crops such as soya beans or sunn hemp could probably be used for the same purpose.

After broadcasting the seed, bushes or branches dragged over the surface provide sufficient soil covering without breaking down the sods. This was found to be preferable to rolling the seed in, as a smooth, compact surface is conducive to wash. It is important not to bury paspalum seed too deeply as this inhibits germination.

Swamp Couch. This grass can only be propagated by roots, but it covers the ground very quickly and eventually forms a dense sward. It is indigenous to the better type of vleis and thrives even under very wet conditions. The most suitable time for planting was found to be in August or September, as this enables the plants to root their runners down before weed-growth after the first rains becomes too dense to allow this to take place easily.

The ground should be disced soon after the second ploughing and the plants set out in hoe-holes spaced 3 ft. x 3 ft. or closer. It is not necessary to plant only rooted pieces as the surface runners may be coiled up and set in the hole with a small piece protruding above ground as well.

Acroceras Macrum (Nile Grass). This is another indigenous vlei grass which can only be planted by roots, but it is very highly palatable and provides useful grazing in winter. It is a good summer grass as well.

It should also be planted at the same time as swamp couch, but it has the advantage of having underground runners which can be completely covered with soil during the planting operation. Thus, instead of placing the grass in hoe-holes, the roots may be dropped into furrows during the second ploughing and the sods of the adjacent furrow are turned over on to them. A discing soon after ploughing evens up the surface sufficiently and leaves it rough enough to prevent wash.

If planting is done in holes these should be spaced 18 ins. x 18 ins., as Nile grass does not cover the ground as quickly as the swamp couch.

After the grasses have been planted out, either by seed or root, it is advisable to fence the vlei off to prevent the entry of cattle until the pasture is well established. If cattle are allowed into the area too soon after planting a considerable amount of damage may be done, as the ground has not had sufficient time to consolidate; young seedlings may be trampled out and root systems may not be well enough developed to prevent whole plants from being pulled out, roots and all. Grazing should, therefore, not be permitted until the second autumn after planting. The vlei pasture should preferably be fenced off into small camps so that rotational grazing can be practised.

Fertilising. Although liming is not a fertiliser, its application is included in this section for convenience.

There is no doubt that the acidity of the vlei soils is an important factor in determining the availability of the plant foods, and for this reason agricultural lime can be recommended as a neutralising or "sweetening" agent. But the amount of lime, and its frequency of application, necessary to produce and maintain this desired effect is not yet known with any degree of accuracy and further investigations are proceeding to determine this.

Results on this station so far have indicated that lime dressings of 1 ton per acre have been beneficial when applied at least every third year. The first application was ploughed in when the land was being prepared, and subsequent applications have been applied as top-dressings.

Applications of other fertilisers at normal rates have been disappointing and have not produced any marked increase in growth, but a more systematic study of the effects of fertilisers on these granite vlei soils is necessary before any conclusions can be drawn. On the other hand, very marked responses have been obtained by the addition of compost at the rate of 10 or 20 tons per acre, plus 1 ton of lime and 500 lbs. of superphosphates. This application resulted in a very fine stand of grass in the first season, and with no further applications of any sort, the sward was still conspicuously better than any other treated area in the second season. In the third season, however, no visible difference in growth could be detected.

Further experimentation is required, therefore, before definite advice can be given on the question of correct fertiliser treatment.

MANAGEMENT

Mowing. After the newly-established pasture has had a full year's rest, it should be mown annually in the late summer to remove mature grass and to provide the aftermath which forms the necessary autumn and the winter grazing. This mowing should take place not later than March-April, so as to allow a good bite to be produced before the cold weather sets in and retards growth. Swamp couch, particularly, should be cut, at this time of the year as old growth is not relished by stock.

Mowing on this station has often been done with the mover blades under water, and the difficulty of removing the cut grass from the water-logged land with wheeled vehicles was overcome by using a hay-tumbler. Actually, if the cut is light, old grass may be left on the land without harming the growth.

Burning. Areas which were burned after the last frosts in August gave less grazing than mown areas, and burning of planted pastures was, on the whole, found to be detrimental. Mowing is definitely preferable, and in any case there appears to be no necessity to burn at any stage. Mowing, moreover, provides good autumn grazing and is not harmful to the pasture.

Grazing. The area of vlei under planted pasture was some 24 acres and this was divided into four six-acre camps which were grazed rotationally, the animals being shifted from camp to camp as soon as the grass was grazed well down. Although there appeared to be very little re-growth during mid-winter, the cattle always managed to find some grazing when brought back to the rested camps.

When the paddocks were mown in February, cattle could be brought in to graze in April-May and remain there for a period of seven to eight months.

The average stocking rate was a beast to two acres, but in very cold frosty winters this was reduced somewhat, and in late spring it was often increased to one beast per acre. From the end of August onwards the amount of vegetative growth increases considerably, although the real flush only takes place with the advent of the warmer weather in October-November.

By keeping the grass well down in winter and giving it a complete rest from grazing during the rainy season the pastures have undoubtedly maintained their productivity over a number of years and provided extremely useful winter grazing. The greatest factor responsible for reducing their grazing capacity has been low rainfalls in the summer. This leads to a reduction in the moisture of the vleis, with the result that new growth is delayed and the number of grazing days decreased accordingly. Even on improved vleis, however, animals will leave a good pasture cover in favour of the dry land flush when this becomes available in sufficient quantity.

Contour Ridging. Experience on this station indicates that contour ridges play an important part in conserving moisture in the vleis, but they have also proved their usefulness in other ways. The first area under pastures was ridged at 18-in. vertical intervals and with a gradient of 1 in 600. Before the grass had established itself properly in the first year, the furrows were used to lead water from the wet, swampy parts to the drier areas, and a more even distribution of water was obtained. Later, when the grass had formed a dense cover in the furrows, this was not practicable any more, but sufficient water was then held up in the furrows to water the stock throughout the winter in most seasons. Level contours would presumably conserve even more water, and this should prove of great benefit in the later part of the dry season when the presence of adequate moisture is so very necessary.

Cost of Establishing the Pasture. Due to inexperience in handling vleis and the lack of any information which might have proved helpful, there was perhaps some unnecessary expense at times when these pastures were first established. The cost of establishment from liming to planting was approximately £2 per acre, with an additional 3/6d. per acre for contouring. The wet conditions of the vlei and planting by roots make a certain amount of hand work necessary and inevitable, but in view of the results obtained with both beef and dairy animals, the expense seems justified.

Productivity of Improved Vlei Pastures. The preliminary results which have been obtained on these pastures may be of interest and are given in Tables 1 and 2. In each case the comparison is made with a control group of similar cattle on natural veld, which includes both dryland and vlei.

The beef steers on natural veld usually had access to 15 acres of grazing, though in some years the area used was rather less. Both groups received no supplementary feed but the animals had a good supply of water and were given salt. The dairy cows on the natural veld received supplementary roughage and concentrate feeds on the usual scale for cream production in this area and had access to the best natural grazing that could be conveniently reached from the cow byres. The cows on the improved vlei received practically no roughage feeds. Both groups were fed concentrates at approximately the same rate per gallon of milk produced.

The data in the following tables refer to the periods in which the steers or dairy cows were on the improved pasture.

TABLE 1.

COMPARISON OF THE GROWTH OF STEERS ON IMPROVED VLEI AND NATURAL VELD DURING THE DRY SEASON.

	Year	Rainfall. Seasonal. July-June, inches.	Duration of experiment.	No. of head in group.	Average age of steers.	GROUP 1.—Improved Vlei.			GROUP 2.—Natural Veld.		
						Liveweight beginning of period.	Liveweight end of period.	Gain or loss.	Liveweight beginning of period.	Liveweight end of period.	Gain or loss.
Experiment 1.	1938/39	46.63	May 22 to Nov. 19	10	Yearlings	466 lbs.	566 lbs.	+ 100 lbs.	450 lbs.	469 lbs.	+ 19 lbs.
	1939/40	46.79	May 6 to Dec. 22	10	Two years	848 lbs.	941 lbs.	+ 93 lbs.	757 lbs.	745 lbs.	— 12 lbs.
Experiment 2.	1941/42	18.31	May 15 to Dec. 21	12	Yearlings	676 lbs.	711 lbs.	+ 35 lbs.	591 lbs.	639 lbs.	+ 48 lbs.
	1942/43	43.00	May 15 to Dec. 9	12	Two years	951 lbs.	1,075 lbs.	+ 124 lbs.	895 lbs.	900 lbs.	+ 5 lbs.

Discussion of Results. (a) Beef Steers. The steers used were purchased as weaners (yearlings) from ranches in Matabeleland. In three years out of four the young stock on the improved vlei gained about 100 lbs. per head for the period May to December. The steers in the group on the natural veld, on the other hand, just about maintained their weight during the same period. In the fourth year, 1942, a season of low rainfall, the growth of grass on the improved vlei during the winter was very poor and the two groups made practically the same gains. In both groups during this particular dry season the gains in weight were made in November and December after the early rains.

In the case of experiment 1, all the steers were sent to the Rhodes Matopo Estate, Bulawayo, in May, 1941, as "three-year-olds" for fattening. At this time the average weight of the ten steers in group 1 on improved vlei was 1,053 lbs., while those on natural veld had an average weight of 996 lbs. After fattening, the steers in group 1 averaged 728 lbs. cold dressed weight, and those in group 2 averaged 652 lbs.—a difference of 76 lbs. The grading was similar for the two groups, both giving four "Rhodesia Bests" and six "Imperials."

At the end of experiment 2, in April, 1944, the steers were again despatched to Bulawayo as "three-year-olds." Their average weights were then: Improved vlei group 1,247 lbs. and veld group 1,125 lbs. liveweight. On this occasion, however, eight of the twelve steers on the improved vlei and one steer of the veld group were judged sufficiently well finished to slaughter without further feeding. The grading of these steers was: Improved vlei, 7 head "Rhodesia Best," 1 "Imperial"; natural veld, 1 "Imperial." After fattening, the remaining steers in the improved vlei group gave an average cold dressed weight of 820 lbs. and those in the natural veld group 721 lbs. All bullocks graded "Rhodesia Best" except one "Imperial" in each group.

In both experiments the steers were $3\frac{1}{2}$ to $3\frac{3}{4}$ years when slaughtered and the weights obtained are considered very satisfactory. The large difference in weight between the two experiments when the steers were despatched to Bulawayo can be attributed to the better steers used in experiment 2 and to the exceptionally good results given by the improved vlei in the winter season of 1943.

(b) Dairy Cows. The cows used in both experiments were high grade Frieslands. In both experiments, as shown in Table 2, it has been possible to maintain the milk production and the liveweight of these cows on improved vlei pasture without any good roughage feeds. The small quantity of legume hay used with the improved vlei pasture in the first experiment was probably unnecessary. The cows for these experiments calved from October to January, as is the normal practice for cream production in this area, and had completed from three to four months of their lactation by the time the experiments started. Neither of the groups received any roughage feeds from the time of calving up to the time the experiments started, but received concentrates at the same rate per gallon. With the small numbers involved the difference in milk production in favour of the group on improved vleis is not significant, but this group received practically no legume hay or silage.

TABLE 2.

COMPARISON OF THE MILK PRODUCTION OF DAIRY COWS ON IMPROVED VLEI AND NATURAL VELD DURING THE DRY SEASON.

Year.	Seasonal rainfall.	Duration of experiment.	No. of cows per group.	GROUP 1. Improved Vlei.		GROUP 2. Natural Veld.		Difference per cow in favour of improved pastures.	*Feed Consumption.	
				Average gain + or or loss — in liveweight per cow.	Average total milk production per cow.	Average gain + or or loss — in liveweight per cow.	Average total milk production per cow.		Roughage feed saved per cow on improved pastures.	Concentrates feed per gal. of milk.
1943	43.0	May 1/ Sept. 30	9	— 6 lbs.	2,921 lbs.	— 6 lbs.	2,733 lbs.	188 lbs.	Legume hay 424 lbs. Maize silage 852 lbs.	Improved vlei 3 lbs. Veld 3 lbs.
1944	38.80	April 1/ Aug. 31	7	+ 53 lbs.	4,017 lbs.	+ 110 lbs.	3,725 lbs.	292 lbs.	Legume hay 904 lbs. Maize silage 2,315 lbs.	Improved vlei 3 lbs. Veld 3.5 lbs.

*In 1943 Group 1 received 117 lbs. legume hay per cow but no silage.

In 1944 Group 1 received no legume hay or silage.

Conclusions. The results summarised in this article apply to the particular vlei pastures at Marandellas. At the time the grasses were established it would have been described as a rather poor sandveld vlei, some parts being very wet and other parts dry. With better or worse pastures, better or worse returns might reasonably be expected. In fact, it should not be difficult to obtain as good results on most vleis where moisture conditions are similar.

From our experience so far it appears that one to two acres of improved vlei of this kind can be expected, under the conditions of the experiment, to carry one growing steer through the dry season and produce a gain on liveweight of about 100 lbs. During the same period young stock on the natural veld, under conditions of good management as at present understood, have usually only been able to maintain their weight. Further, the young stock on the improved vlei have avoided the annual setback which adversely affects the quality of beef cattle in this Colony under ordinary farm conditions.

In regard to dairy cattle, these trials have shown that it is possible to maintain a fairly high standard of production on these improved pastures through the dry season without the use of the ordinary roughage feeds such as silage and legume hay. A good production of milk was maintained on concentrates alone, fed at the rate of approximately 3 lbs. per gallon. Further, the cows on these improved pastures, benefiting from the green bite, have calved down subsequently in better physical condition and with less difficulty than other cows calving under the usual dry conditions which at present obtain on most farms at this time of the year.

It is not possible to assess these advantages closely from a financial standpoint as conditions vary so greatly from farm to farm. This aspect of the matter must to a large extent be determined by the individual farmer from his own experience. The trials indicate, however, what amount of feed may be saved in feeding young stock or dairy cows in the dry season and the kind of benefits which may be expected from establishing improved pastures on sandveld vleis.

As more experience is obtained in the management of these vleis, and more is known about the most suitable grasses for different conditions, it should be possible to improve materially on the results obtained in these trials. A considerable extension of these pastures on the Station is now being made to secure more information on this subject.

An important aspect also is that by establishing improved pastures, areas of wet vlei of low carrying capacity may be transformed into pastures of comparatively high carrying capacity. In this case a vlei, consisting originally mostly of unpalatable grasses and sedges, has become a valuable winter pasture. The improvement of vleis on these lines may well prove a decisive factor in the development of intensive farming in the higher rainfall areas in this Colony.

Tobacco Culture in Southern Rhodesia.

HARVESTING AND CURING VIRGINIA TYPE TOBACCO.

By D. D. BROWN, Chief Tobacco Officer.

The value of tobacco is dependent upon quality and, unless proper care is exercised during the harvesting and curing stages, the financial return to the grower may be seriously reduced through lack of quality in the cured leaf. Mistakes in either operation cannot be rectified when once they are made. The question of quality is of primary importance, and it will become increasingly so with the growth of intensive competition with other tobacco-growing countries.

Ripening Stage. The young tobacco plant, when growing vigorously, carries leaves of a deep green colour, which at this stage are soft and pliable. This dark green colouration is a sign of a plentiful supply of nitrogenous constituents, which go to make up the living or vital parts of the leaf, and which are necessary for the building up of the food supply of the plant.

At about the time the leaves as a whole have reached their maximum power of elaborating the food supply, the flower head begins to develop. This food supply, consisting of starch and other substances, is carried from the leaf into the seed head to furnish the necessary food for the development of the seed. Then, having fulfilled their purpose, the leaves pass naturally into the period of gradual decay.

In practice, however, the terminal bud is removed from the plant to prevent the development of seed. Making a last effort to reproduce itself, the plant then sends out secondary shoots or suckers, but these, too, are removed by the grower. Thus translocation of the food material from the leaves to other parts of the plant is arrested and both the size and body of the leaf are increased. The surplus food supply which accumulates in the leaf also induces ripening, and, later, unless the leaves are harvested, gradual decay.

Actual and personal experience is required before the grower is fully able to determine when tobacco leaf is properly ripe, but the following description may prove helpful.

Normally the crop will start to ripen approximately ninety days after the date of transplanting. The lower leaves ripen first and the top leaves are the last to reach maturity. The first indication of ripeness is a change in the colour of the leaf, provided this change is not caused by conditions other than maturity of the plant. In seasons of severe drought or excessive rainfall, the leaves will often turn yellow before the plant is fully ripe. Plants affected by disease will also change colour prematurely; root-knot nematode is another common cause of this condition. The leaves of plants thus affected fail to cure properly, and lack the necessary quality.

The dark green colour of healthy, light-bodied leaf gradually changes to a greenish yellow as the tobacco reaches maturity. In the case of heavy-bodied leaf, the yellow may appear only in flecks or spots and the tip of the leaf curls down and in towards the stalk of the plant.

The accumulation of starchy materials in the leaf causes it to become thick, brittle and the surface rough; this change from being pliable and smooth to the touch is another sign of ripeness. Such leaf will crack when folded and pressed between finger and thumb.

Speaking generally, the higher up the stalk the leaves are, the more pronounced the change in colour and the general signs of ripening must be before they are ready for harvesting. Furthermore, the heavier the leaf, the riper it should be before picking. The number of leaves ready for harvesting varies according to the plant. Generally, however, from two to four leaves per plant reach maturity about the same time.

Successful curing of tobacco requires a combination of good judgment and careful workmanship. Much of the success in curing depends on harvesting the tobacco at the right time, when it is neither too ripe nor too green. The degree of maturity, however, which the tobacco should attain varies according to type and the method of curing employed. The correct degrees of ripeness necessary to secure the best results in each method are:—

Air curing—Almost fully ripe leaf.

Sun curing—Almost fully ripe leaf.

Flue curing—Fully ripe leaf.

Fire curing—Fully ripe leaf.

Harvesting. Tobacco may be harvested by cutting down the whole plant or by the removal of individual leaves. The former method is employed principally in the case of sun-cured, air-cured and fire-cured tobacco. It is an economical method as regards labour requirements but has the drawback that all the leaves on the plant are not in the same state of ripeness when harvested; also there is an increased loss in the weight of the leaf during the curing process. When harvesting by the whole plant method, it is advisable to use a suitable knife to split the stalk down the

centre to within about six inches of ground level. Then, the plant being held slightly down and away from the operator, a slanting cut severs the stalk from the root. The plants are then allowed to wilt slightly, after which they are placed astride the curing sticks. One such stick will hold from six to ten plants, depending upon their size. The sticks, when filled with their complement of plants, are next placed on a trolley and conveyed to the barn or curing racks, as the case may be. Tobacco should be carefully handled, otherwise the leaves may become bruised and damaged.

Flue-cured tobacco is harvested by the single leaf or "priming" method, as this system has proved to be particularly suitable and renders easier the filling of the barn with leaf uniform in ripeness and texture. This method is now generally adopted also in the harvesting of sun-cured, air-cured and fire-cured tobacco in Southern Rhodesia. Usually the number of pickings required to complete the harvest is from three to six, depending on the growth of the plants. By this means, leaf of uniform ripeness is picked and then placed either in crates, baskets, "machilas" or sleighs specially constructed for the purpose. A very suitable receptacle made and used by many tobacco growers is manufactured from ordinary bush poles and hessian. Reed mats may be substituted for hessian when the latter material is unobtainable. The frame is made of poles (about three inches diameter), the two top members being six feet long and extending about twelve inches beyond the ends of the crate and serving as handles. For convenience in stowage, the fixed handles might be replaced by detachable poles. These are passed under the top cross-bars at either end and held in position by wire loops fixed at the four top corners. One set of such handles will serve for a number of these crates. A similar arrangement can also be applied to the iron crates manufactured and sold by local firms. Laths are placed across the bottom of the framework to prevent the hessian from sagging when the crate is filled with leaf. The sides and ends are stayed diagonally with heavy gauge wire. Hessian is sewn to the inside of the framework to cover the bottom, sides and ends of the crate. A loose flap is also sewn along the top of one side and used to cover the tobacco and protect it from sunburn. The average crate is four feet long by two feet wide by two and a half feet deep.

These crates are carried about the field and when filled are loaded one on top of the other on a wagon or lorry. One or two crates may be placed on a sleigh for transport to and from the field. This method, however, is not generally recommended because of soil erosion resulting from sleigh tracks.

During harvesting and stringing operations the tobacco must be carefully handled to avoid bruising or tearing the leaf.

The containers holding the tobacco are next carted to the stringing shed where the leaf is carefully removed and placed on tables or on the floor within easy reach of the natives employed in tying the leaf on to sticks. During the tying process, the sticks are supported on racks formed by posts let into the floor at intervals of about four feet and extending some three feet above floor level. The tobacco is strung in bunches of from two to five leaves, depending on their size, and in each bunch the leaves are placed back to

back or midribs towards the centre. When dealing with large, heavy leaf, only two leaves are placed in each bunch, and in the case of small, light-bodied tobacco, the number may be increased to four or five leaves per bunch.

Sail twine or soft string is used for tying the tobacco, one end being securely fastened to an end of the stick before the operator commences to deal with the leaf. When tying tobacco, the string should be wrapped approximately one and a half inches below the leaf butts. Placing the string lower than this results in bruising and discolouration of the base of the leaves. The string is held in one hand and, with the other, a bunch of leaves is placed in position close to the stick. The string is then wound one and a half times round the leaves before the bunch is turned and slung over and across the stick to complete the operation. The next bunch of leaves is hung on the opposite side of the stick and about three inches in advance of the last bunch. Thus the bunches are staggered down the length of the stick and the weight of the tobacco is supported by the string zig-zagging along the top of the stick.

When the stick is filled with tobacco—generally 32 bunches of leaves—the free end of the string is wrapped round and tied to the end of the stick, which is then ready for the barn or curing racks, as the case may be.

In cured tobacco the colour, texture and quality of the leaf are the important features. When harvested before the proper time the leaf will retain a green colour and be of little or no commercial value. If picked when over-ripe, the colour will be uneven and blotchy, and the texture harsh and lacking quality.

For flue-cured tobacco especially it is essential that the barn should be filled each time with leaf which is uniform in ripeness, body and texture. If tobacco in different stages of maturity and varying in body and texture is placed in the barn, there will be a corresponding variation in the curing rate of the leaf, and lack of uniformity in the cured product. Close personal attention to these details is required from the grower if a frequent cause of serious loss is to be avoided.

Curing. Curing is an essential and important phase in the production of tobacco and is the descriptive term applied to the process by which the newly harvested leaf is first coloured and then dried. There are several methods of curing tobacco, namely, air-curing, sun-curing, fire-curing and flue-curing. The purpose for which the leaf is to be used, as well as the soil and the climatic conditions under which the crop has been grown, largely determines the method of curing. Although these methods differ in some respects, there are certain basic principles which are common to all.

Heat and moisture are the principal factors controlling the process of gradual starvation which the leaf is forced to undergo in curing. Curing is largely a physiological process and the principal changes in composition must therefore be brought about before the leaf is killed. The surplus supply of food stored up in the leaf during the ripening period enables it to live for several days after harvesting.

When harvested, mature leaf is estimated to contain approximately 80 per cent. of water, most of which is lost during the curing, when it is gradually expelled from the tissue of the leaf. Certain chemical and physiological changes also occur which bring about those desirable qualities found in properly cured tobacco. These changes in the composition and character of the leaf, which take place during the curing, are not yet fully understood.

The rate of drying has an important effect on the result of curing. If the leaf is dried out too rapidly, it is killed prematurely and the curing ceases. On the other hand, if the rate of drying is too slow, the curing is prolonged. In either case the tobacco will be spoiled, firstly by remaining green in colour and harsh and lifeless in texture, and secondly by being "sponged" and lacking in quality.

Air-Curing. This method of curing is the simplest, and is very extensively employed; a great part of the world's tobacco supply is thus cured. Air-curing is a natural process, for the tobacco is harvested and placed in the barn to be cured under ordinary atmospheric conditions. The results are dependent almost entirely upon climatic conditions obtaining during the curing period. If conditions are suitable and proper care has been taken in harvesting, the leaf will cure out well.

In order to overcome the effects of unfavourable weather during the curing, growers have in recent years introduced artificial means (heat and moisture) which somewhat modify the process.

When an excessively hot, dry spell sets in immediately after the tobacco is placed in the barn, the leaf may be killed prematurely, which results in undesirable colour and lack of quality, coupled with a serious reduction in value. On the other hand, when wet weather occurs, heavy loss may be caused through "pole-sweat," and the colour and quality of the leaf may be adversely affected. The ideal climatic conditions for air-curing are clear, calm days, moderately dry atmosphere and a temperature of 80 to 90 degrees F. in the shade. Under these conditions the moisture given off from the leaf is readily absorbed by the atmosphere, oxidation is reduced to a minimum and the tobacco cures moderately bright in colour. The occurrence of wet weather during the final stages of curing and before the removal of the tobacco from the curing shed will cause the leaf to turn red.

The time generally required for air-curing is from six to twelve weeks, depending on the nature of the tobacco and the climatic conditions prevailing during the curing. When the single leaf method of harvesting is employed, the tobacco will cure in less time than would be required in the case of curing the whole plant.

Normally, all leaf should turn yellow before it begins to dry out. If it dries before yellowing, the leaf will remain a green colour and be of small value. When drying is delayed too long after the yellowing, oxidation takes place, causing the colour of the leaf to change to red or brown.

The purpose for which it is to be used determines, in a large measure, what the desired colour of the leaf should be, and the curing should be arranged accordingly. For the manufacture of

cigarettes, lemon yellow to light orange-coloured leaf is required, whilst leaf for pipe mixtures, plugs and twists will range from light red to dark brown. In the case of cigar tobacco, the requisite colours are shades of brown and olive.

When filling the curing shed, the sticks of tobacco are hung up on tiers, starting from the topmost tier and working down to the lowest. Much damage may be caused by placing sticks, holding the entire tobacco plant, in the wrong order. Any one tier should not be filled before another is commenced. The correct procedure is first to place one stick on the highest tier, then the following stick on the next tier down, with the butts of the tobacco plants just touching the tips of the plants suspended from the stick above. The next stick is then hung on the third tier down and placed in similar relation to the stick above, as indicated in the case of the first and second sticks. This order of filling is continued until the bottom stick has been suitably placed on the last tier, when the same order is observed by commencing again at the top and working downwards as before. This is continued until one section or "room" is filled. Each section is completed in proper sequence until the barn is fully packed. The filling of a barn should be commenced at a point furthest from the door, leaving the section by the door until last.

At first the tobacco sticks are placed along each tier at intervals, which allow the plants to touch, but not come in too close contact. The usual spacing is about six to eight inches, depending on the length and girth of the plants. Later on, when the tobacco is sufficiently yellowed in the barn, the spacing between sticks may be increased in order to hasten the drying of the leaf. During excessively dry weather, the sticks of tobacco should be kept closer to prevent the leaf drying out too rapidly, and to enable it to turn a suitable yellow colour.

The atmospheric conditions in the barn should be so controlled that the relative humidity is fairly high during the wilting process, the wet bulb of the hygrometer registering between 2½ degrees and 3 degrees below the dry bulb. If the difference in the reading between the wet and the dry bulbs be greater than 3 degrees, more moisture should be introduced into the barn. On the other hand, if the difference is less than 2½ degrees, the humidity must be reduced by ventilation or by heating. The temperature of the barn should be maintained at from 70 degrees to 75 degrees F. during the wilting process. When the tobacco has changed to a pale greenish-yellow colour, the temperature should be increased to 80 degrees F. and then to 90 degrees F. The relative humidity should be decreased in order to allow the leaf to commence drying. Care must be exercised at this critical stage in the curing, otherwise the tobacco may be spoiled either by drying too quickly and remaining green, or through excessive moisture and delayed drying causing sponging and, in extreme cases, "pole-sweat."

After the leaf has yellowed, the rate of drying should be gradually increased by use of ventilators. In barns fitted with flues the curing may be hastened by lighting the fires and raising the temperature gradually to 100 degrees F., then to 105 degrees F. and finally to 110 degrees F. Temperatures higher than 110 degrees F. would impair the main characteristics of air-cured tobacco and are therefore not to be recommended.

It is possible also to combine the air-cured and sun-cured methods. The tobacco is first placed in the air-curing barn and is wilted and yellowed in the usual manner, after which it is removed from the barn and the curing process is completed by sun-cured methods. The partly-cured tobacco is conveyed to the curing racks, where it is exposed to the direct rays of the sun until the leaf is thoroughly dried out. After the tobacco is fully coloured and dried, it should be carefully removed from the racks. Over-exposure to the sun will result in undue bleaching of the leaf.

Speaking generally, climatic conditions during the early part of the season are not conducive to good results, and if air-curing were to be properly developed in Southern Rhodesia, it would be necessary to use suitable air-curing barns. In other countries where this method of curing is practised, the barns are both elaborate and costly. The erection of grass sheds, in which the tobacco is more or less exposed to the elements, cannot be recommended and the results are likely to prove disappointing.

Sun-Curing. Sun-curing is similar to air-curing in that no artificial heat is employed. In other features, however, it differs. The rate of curing is accelerated by exposing the leaf to the direct rays of the sun, whereas in air-curing the rate is primarily regulated by atmospheric conditions.

In addition to a packing shed, bulking shed and conditioning pit (all of which are required on every tobacco-producing farm), a wilting shed and curing racks are essential equipment.

The wilting room is used for yellowing the leaf before the tobacco is placed out on the racks for drying. This room or shed should be kept fairly dark and cool and have ventilation facilities for the control of temperature and humidity. Besides serving as a wilting room, the building may also be used for conditioning the cured leaf.

The curing or drying racks are constructed from native timber and heavy gauge wire. These racks consist of a series of parallel wires stretched over stout poles about five feet long, planted upright in the soil, leaving three feet standing above ground level. The posts should be carefully aligned and spaced at regular intervals of ten feet one way and four feet in the opposite direction. The lines of posts spaced at ten feet are best aligned to run north and south in order that the tobacco may have the maximum exposure to the sun. Wire is drawn taut along the tops of these posts, thus forming a rack with the parallel wires four feet apart.

Light gum or bush poles or bamboos may be used in place of the wire horizontals if supplies of suitable wire happen to be unobtainable.

Curing racks should be erected on a reasonably level piece of land, well sheltered from high winds and in close proximity to the lands, wilting room, conditioning pit and storage sheds. Furthermore, the selected site should be fully exposed to the sun. Approximately 150 yards of rack space is required per acre of tobacco planted.

For sun-curing, the tobacco may be reaped either by the whole plant or by the single leaf or "priming" method. The latter method is now generally preferred in this Colony. The usual practice followed in sun-curing is to harvest the leaf just before it is fully ripe. The tobacco is then strung on sticks and placed in the wilting room, where it remains until the leaf turns a greenish yellow. When the leaf is properly yellowed, it is removed from the wilting room and placed on the drying racks. The tobacco remains on the racks, exposed to the direct rays of the sun, until both the web and midrib are thoroughly dried out. The time usually required for sun-curing is from four to six weeks.

During this period the tobacco on the racks requires covering at night, and, in the event of inclement weather, during the day also. For this purpose light water-proofed coverings are most suitable, but grass or reed mats or loose grass may be used. After the tobacco has been on the racks from four to six weeks, it should be ready for removal to the conditioning pit preparatory to bulking. The cured tobacco should be removed from the drying racks in the early morning or during misty weather while the leaf is soft and pliable, otherwise the tobacco might be seriously damaged by handling when the leaf is dry and brittle.

Where it is absolutely essential to have the racks cleared within a certain time, growers may sometimes resort to the expedient of taking down the sticks from the racks about sundown. The sticks are placed flat down on the grass and the tobacco is left fully exposed to the dew overnight. The leaf will then be soft enough for handling by sunrise the next morning. Should the dew be heavy, the tobacco will lose colour through becoming wet. This practice is, therefore, not recommended, except in cases where the removal of the tobacco within a certain time is imperative.

The sun-curing method can be recommended where the soil and climatic conditions are suitable for the production of a heavy type of tobacco. Tobacco intended for sun-curing should be ready for harvesting when the rains normally cease, and the planting of the crop should be arranged accordingly.

Sun-cured tobacco differs somewhat from air-cured leaf and possesses certain desirable qualities. It is usually lighter and more uniform in colour and is sweeter and more aromatic. This type of leaf is used chiefly for chewing tobacco and pipe mixtures.

Fire-Curing. This method calls for the use of fire during the curing process. Heat is furnished by means of open fires made in shallow pits or trenches dug in the floor of the barn. The smoke from the burning wood imparts a creosotic flavour and distinctive aroma, besides improving the keeping qualities of the tobacco. Leaf for fire-curing must be fully ripe and may be harvested either by the whole plant or by the "priming" method. The tobacco is hung in the barn in similar manner to that already described for air-curing and sun-curing. The sticks are placed at intervals of from six to eight inches along each tier. The tobacco is then allowed to hang for four to seven days, during which time the leaf should yellow. After four to seven days, when most of the tobacco in the barn is yellow, small fires are lighted in the trenches dug in the floor, and the temperature of the barn is gradually increased to

about 100 degrees F. This temperature is maintained until the tips and edges of the leaf begin to curl and turn brown, when the fires are put out and the barn allowed to cool down. This will allow the sap to run back into the leaf, and the brownish parts of the leaf to become pliable. The fires are then re-started and the temperature raised to a few degrees higher than during the preceding stage.

When the brown colour begins to spread from the edges towards the midrib and the brown coloured part of the leaf becomes brittle, the fires are again removed and the barn allowed to cool and the sap to spread. This process is repeated, and as the curing progresses, the temperatures are increased each time after the fires are re-lighted. It is seldom advisable to raise the temperature higher than 125 degrees F. The cured leaf should be of good size and body and a uniform dark brown colour.

The desired qualities of the cured leaf may be seriously affected by being subjected to excessive quantities of smoke, which will leave heavy deposits on the leaf and blacken the tobacco. The fuel used for burning in fire-curing barns should be selected from hard woods which do not create any unpleasant smell whilst burning. Shelled maize cobs also form a suitable fuel.

After the curing is completed, the tobacco is brought into condition and bulked preparatory to grading and baling. The time taken for fire-curing is between two and three weeks, according to the size of the tobacco and seasonal conditions during the curing period.

Flue-Curing. In flue-curing, artificial heat is applied continuously throughout the curing period. Heat is generated in suitably constructed furnaces using either wood or coal fuel, and flues radiate this heat in the barn. There are also special curing systems employing oil burners, steam radiators and electric radiators, which dispense with the use of the conventional type of flue and provide more accurately controlled heating.

Flue-curing is the most modern method of curing tobacco and requires constant and careful attention to every detail. The skill and care exercised during the curing have a direct influence on the value of the tobacco produced. Typical flue-cured tobacco ranges in colour from bright yellow to dark brown. Clear lemon-coloured leaf, however, is in the greatest demand and commands the highest prices. Green is the colour least desired, and the curing should be so regulated that the proportion of green coloured leaf is kept at a minimum. Care in harvesting the tobacco will assist in reducing the quantity of green-coloured leaf in each curing. On the other hand, the leaf should not be fully yellow when it comes from the barn. It is found that the most successful curing and clearest colouring results when the tobacco is dried out with a slight greenish tinge. It is important also that the barn be filled in one day with leaf of the same texture and ripeness so that the tobacco will yellow at practically the same time and cure uniformly. *There are many formulae advanced for this method of curing, and and any one may be correct under certain conditions, but they cannot all be correct at one and the same time.* The type of leaf and the climatic conditions obtaining during the process will largely

regulate the rate of curing; for instance, heavy-bodied leaf will be longer in curing than light leaf, and leaf which is yellow when picked will cure faster than green-coloured leaf.

In order to control the rate of drying, the temperature in the barn must bear a certain relation to that of the outside air. The correct difference between the temperature inside the barn and the air outside will be determined by the humidity of the latter. The moisture-holding capacity of air increases as the temperature rises, consequently higher temperatures are required in the barn during wet weather than in dry weather, and lower temperatures are required in cool weather than in warm weather.

The state of the outside air has also to be considered in regulating the ventilation of the barn during the time the tobacco is being cured. A dry outside atmosphere calls for reduced ventilation through bottom ventilators, and top ventilation should also be reduced to a minimum so that the leaf will not dry out too rapidly and too green. In wet weather the bottom ventilation is reduced and top ventilation is increased in order to expel moisture-laden air from the barn.

During excessively wet spells, and when the leaf is heavy-bodied and contains a good deal of water, it may sometimes be advisable to open the top ventilators slightly, when the temperature in the barn reaches 105 degrees F. to 110 degrees F. This reduces the amount of "sponging" which often occurs when the barn is kept closed until the temperature of 115 degrees F. (the temperature to be reached before ventilation is generally recommended under normal conditions) is registered within the barn. The top ventilators are at first opened slightly and the opening gradually increased in order to drive off the excess moisture from inside the barn. The bottom ventilators should be kept closed at this stage of the curing, or only a strictly limited amount of ventilation allowed, as too much ventilation through the bottom vents would defeat the end in view by introducing a fresh stream of moisture-laden air into the barn.

In flue-curing there are three distinct stages through which the leaf must pass, namely, yellowing, fixing the colour, and drying the leaf and midrib.

Yellowing the Leaf. This is accomplished by subjecting the tobacco to low heat with high humidity. As soon as the barn has been filled, the door and ventilators should be closed to prevent the escape of moisture. A thermometer (maximum and minimum reading and graduated in single degrees up to 170 degrees F.) and a hygrometer should be suspended from the bottom tier in the centre of the barn. The wick on the hygrometer wet bulb should be properly fitted and must be kept moist, otherwise the difference between wet and dry bulb readings will be inaccurate. Next a small fire is lighted in the furnace and the temperature in the barn is raised to 90 degrees F. during the first three to six hours. In the early stages of curing, a low heat is essential until the leaf yellows; a high temperature at this stage would ruin the tobacco. The temperature is therefore kept at 90 degrees F. until the leaf starts to yellow at the tips and round the edges.

This generally occurs in about 24 hours early in the season, and twice or three times as long later in the season when outside air temperature is low and the tobacco is not ripening in the field. Next the temperature is raised to 95 degrees F., and this heat maintained until the yellow colour begins to spread in towards the midrib of the leaf. The temperature is next increased gradually to 100 degrees F., and held there until the yellow colour is more pronounced.

During this time the atmosphere of the barn should be saturated to prevent the leaf from drying out. Sufficient moisture must be kept in the barn to give a reading of 3 degrees or 4 degrees difference between the wet and dry bulbs of the hygrometer. Should the wet bulb register more than 4 degrees below the dry bulb, it signifies that the air inside the barn is becoming too dry.

In this case more moisture must be introduced by pouring water on the floor and lower walls and placing wet bags on the flues. Instead of water, low-pressure steam may be introduced until the required degree of humidity has been attained.

When the leaf begins to show more yellow in colour, the temperature is increased to 110 degrees F., and this heat is maintained until the leaf is yellow, with only a slight greenish tinge. The temperature is then gradually raised to 115 degrees F., and held there until the proper yellow colour is developed. Between the temperatures of 100 degrees F. to 115 degrees F. the humidity in the barn is gradually reduced until the wet bulb registers 12 degrees below the dry bulb. Maintaining the requisite degree of humidity in the barn during the yellowing stage is very important.

Fixing the Colour. This is the most critical stage in curing and it is here that many a barn of good tobacco becomes spoiled. The greatest care in the manipulation of the barn is therefore required. The leaf will turn a reddish brown colour if the atmosphere of the barn is too humid, or if the ventilation is inadequate and the temperature is not increased fast enough. This discolouration of the leaf is known as "sponging," and is caused by moisture collecting on the surface of the leaf. Raising the temperature too rapidly when there is an excess of moisture in the leaf will cause "scalding" and reddish-brown or greenish-black coloured areas to appear on the leaf. Another discolouration is caused through the cells of the leaf being prematurely killed, preventing the necessary chemical changes from taking place. This happens when the ventilation is excessive and the temperature is increased too rapidly. The leaf in this case has a dark greenish-red or blackish colouration. Sponged tobacco is of more value than green or blotched leaf, but the grower should try to eliminate all these classes of leaf.

The main object in fixing the colour is to prevent any further change in colour after the yellowing stage is passed. The barn should be so managed that the moisture is carried off through the ventilators as fast as it is given off by the leaf. The temperature is regulated in such fashion that the colour will be normally fixed in 15 to 18 hours. The top and bottom ventilators are slightly opened when the leaf is yellowed, and the heat registers 115 degrees F. When the vents are opened, the fire should be increased to maintain the required temperature in the barn. The ventilation is

gradually increased while the heat is maintained at 115 degrees F. until the tips of the leaves begin to curl upwards. The next step is to increase the temperature to 120 degrees F., and hold it there until the leaf begins to curl in towards the midrib. The leaf is now drying and the temperature is further increased to 125 degrees F., this temperature being maintained until the web of the leaf is about dry and the difference between the wet and dry bulbs is about 25 degrees.

Drying the Leaf. To complete the curing it is necessary to dry the leaf thoroughly, and this is accomplished by raising the temperature from 125 degrees F. to 130 degrees F. in two hours' time, after the web of the leaf appears to be dry. The temperature should be maintained at 130 degrees F. for about four hours, then raised to 135 degrees F. in one hour and held there for approximately four hours, by which time the web of the leaf should be thoroughly dried out. Ventilation is next reduced and temperature increased hourly by 5 degrees, until 160 degrees F. is attained This heat is maintained until the midribs are thoroughly dried and brittle. The fire should then be drawn and the barn allowed to cool down. Temperatures exceeding 160 degrees F. are not recommended, nor should they be necessary except where the whole plant method of harvesting is employed, in which case the maximum is 180 degrees F.

By using temperatures much higher than 160 degrees F. growers cause a decline in the quality of the tobacco. Excessive heat makes the leaf very brittle and lacking in texture. The colour of the leaf is also impaired and may take on a reddish cast commonly described as "scorching."

It must be clearly understood that the foregoing temperatures are given only as a guide, and while being correct under certain conditions, they are not expected to be suited to the curing of every barn of tobacco during each and every season.

The grower will find the above guide useful in deciding how the curing is progressing and, by modifying the heat, moisture and ventilation, will be able to arrange the rate of curing to suit the type of leaf in the barn and the climatic conditions prevailing during the curing period. Normally the time required for flue-curing tobacco is from four to six days.

The provision of cement-covered floors and the use of hot air ducts for ventilation of the barn will enable the grower to cure the tobacco to better advantage. An excessive quantity of water poured on the floor will induce "sponging," particularly in the case of earthen floors. A thoroughly saturated earthen floor is a common cause of difficulty in the reduction of the relative humidity when the temperature has reached 130 degrees F. approximately. At this temperature a great deal of moisture is driven out of the floor; hence the increased humidity, even though the same barn appeared to have the correct degree of humidity at, say, 120 degrees F. or 125 degrees F. All barns should have brick floors covered with a thin coating of cement, as it is then easier to control the humidity, especially if drain plugs are let in through the wall to run off surplus water when it is no longer required in the barn. The use of warm or pre-heated air in place of cold air commonly introduced

into the barn during ventilation will also reduce the amount of "sponging." Further efficiency is gained by the installation of efficient furnaces, flues and improved circulation of air in the barn.

Handling the Cured Leaf. After the tobacco is cured it is extremely brittle and cannot be removed without serious damage unless the leaf is conditioned and rendered soft and pliable before being handled. Tobacco becomes soft when exposed to damp atmospheric conditions; these conditions may be brought about by the use of low-pressure steam, water, or a combination of both in the curing barn. Partially conditioned leaf may be carefully removed from the barn and placed in a conditioning pit until the leaf becomes fully pliable. This is the method generally adopted in the case of air-cured and sun-cured tobacco.

The characteristics of the cured tobacco are either improved or spoiled in the subsequent handling. When properly handled the leaf will improve in colour and quality, but if badly handled the reverse will be the case. Care should be taken not to over-condition the tobacco otherwise the colour will darken and the quality deteriorate. Speaking generally, the brighter the colour the less the degree of condition into which the leaf should be brought. On the other hand, tobacco should not be too dry. When in proper condition for bulking, the web of the leaf and lower half of the midrib are pliable, but the upper half of the midrib should be only slightly supple.

When ready, the tobacco is removed from the barn or conditioning pit to the bulking shed and is placed in bulks which may be built either with a circular or rectangular base. The tobacco is first untied from the sticks and roughly graded into four grades, viz., bright, medium, dark and green. Each of these grades should then be bulked separately. The bulks can be made any convenient length and width and about six feet high. They should be built on raised platforms allowing an air space between the platforms and the floor to prevent the bottom layers of leaf from becoming mouldy. Growers sometimes bulk tobacco for a while on the sticks as it comes from the barn, and in this case also the same attention is required in regard to the moisture content of the leaf and general handling of the tobacco.

The bulks should be inspected carefully at regular intervals, and if any tobacco is found to be overheating or becoming mouldy, the bulk must be broken down and rebuilt after the leaf has been shaken out and aired. When turning bulks, the tobacco which formed the centre of the old bulk is placed to the outside, and in the same way the bottom tobacco is placed on the top of the new bulk. This will ensure greater uniformity in the leaf when it is finally removed from the bulk to be graded.

The majority of growers now send their tobacco to commercial tobacco grading warehouses to be graded and packed for sale over the tobacco auction floors. It is, therefore, not proposed here to discuss the question of grading and baling tobacco except to state that when baling the tobacco for despatch to the warehouse care should be taken that the leaf in each bale is in good keeping condition and of approximately the same grade. The weight of the bale should be approximately 180 lbs.

In conclusion, it may be stated that, to become thoroughly proficient, a tobacco grower needs to gain experience through the actual handling of the crop, for there are certain details concerning the growing, harvesting, curing and handling of tobacco which cannot be fully mastered except through personal experience.

SUMMARY.

(1) The harvesting of tobacco requires care and good judgment and is closely related to the value of the cured product.

(2) Get to know when a leaf is ripe, and harvest leaf when it is suitably ripe for the process by which it is to be cured.

(3) Uniformity in harvesting makes for uniformity in curing.

(4) Green tobacco is of low value; take every precaution to produce the absolute minimum of undesirable leaf.

(5) Harvesting of tobacco is facilitated by having adequate barn accommodation.

(6) The tobacco should be carefully handled during the harvesting, otherwise damage may result for which you have to pay.

(7) The curing of tobacco is a scientific process and requires to be studied as such.

(8) Buildings suitable for the purpose are an aid to satisfactory curing.

(9) Do not overcrowd the barn; money is lost when the leaf is damaged through being too tightly packed for curing.

(10) Have your buildings and plant for curing put in working order before the crop is due for harvesting.

(11) Provide for adequate supervision throughout the harvesting and curing of the crop.

(12) Endeavour not to grow more tobacco than can properly be accommodated in your buildings; excessive quantities of tobacco in relation to housing accommodation usually lead to the production of a lower grade leaf.

(13) Every effort should be made to produce quality rather than quantity.

(14) Conserve fuel by the use of efficient furnaces, flues and improved circulation of air in the barns and provide for future fuel requirements by planting trees to replace indigenous trees already cleared off the land.

Southern Rhodesia Veterinary Report.

NOVEMBER, 1946.

Diseases. African Coast Fever: No additional farms reported infected during the month. Anthrax: An outbreak of Anthrax occurred in the Bulawayo and Fort Victoria districts.

Mallein Test. 43 horses and 4 mules were tested with negative results.

Tuberculin Test. 4 head of cattle were tested with negative results.

IMPORTATIONS.

United Kingdom: 1 horse.

Union of South Africa: 6 bulls, 10 cows (breeding), 2 donkeys, 52 horses, 4 mules, 40 goats, 229 sheep.

Bechuanaland Protectorate: 44 oxen.

EXPORTATIONS.

Union of South Africa: 4 horses.

Northern Rhodesia: 8 bulls, 88 donkeys, 1 horse, 16 pigs.

Belgian Congo: 12 oxen.

Portuguese East Africa: 28 oxen, 15 cows.

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage.

Northern Rhodesia: Bacon, 15,284 lbs.; beef, 386,092 lbs.; sausages, 1,352 lbs.; offal, 7,604 lbs.; mutton, 37 lbs.; fats, 5,690 lbs.; veal, 1,285 lbs.; brawn, 148 lbs.; polony, 2,106 lbs.; pork, 5,755 lbs.

Union of South Africa: Bacon, 20,642 lbs.; offal, 44,288 lbs.; fats, 2,902 lbs.; pork, 72,226 lbs.

Belgian Congo: Bacon, 3,606 lbs.; beef, 175,929 lbs.; offal, 5,742 lbs.; veal, 3,936 lbs.; poultry, 68 lbs.; pork, 3,757 lbs.

Bechuanaland Protectorate: Bacon, 255 lbs.; beef, 8,085 lbs.; sausages, 202 lbs.; offal, 153 lbs.; fats, 187 lbs.; brawn, 77 lbs.; polony, 233 lbs.

Meat Products from Liebig's (Rhodesia), Ltd., West Nicholson.

Union of South Africa: Corned beef, 48,960 lbs.; Oxo fluid, 162 lbs.; Vienna sausages, 10,395 lbs.; lunch roll, 4,725 lbs.; pate de fois, 2,030 lbs.; ass. spreads, 15,950 lbs.; sandwich spread, 8,775 lbs.

Belgian Congo: Oxo fluid, 225 lbs.

P. D. HUSTON,
Chief Veterinary Surgeon.

DECEMBER, 1946.

Diseases. African Coast Fever. No additional farms reported infected during the month.

Mallein Test. Fifty-six horses and 617 donkeys were tested with negative results.

Tuberculin Test. One bull was tested with negative result.

IMPORTATIONS.

United Kingdom: 4 cows and calves (breeding).

Union of South Africa: 8 bulls, 8 horses and mares, 53 geldings, 554 sheep (slaughter).

Bechuanaland Protectorate: 302 oxen (slaughter).

Northern Rhodesia: 5 horses and mares.

EXPORTATIONS.

Union of South Africa: 617 donkeys.

Northern Rhodesia: 6 pigs (breeding).

Belgian Congo: 1 pig (breeding).

Portuguese East Africa: 12 bulls, 25 oxen (slaughter).

Nyasaland: 10 pigs (breeding).

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage.

Northern Rhodesia: Bacon 5,649 lbs., sausages 50 lbs., beef 35,085 lbs., offal 2,394 lbs., fats 1,474 lbs., veal 574 lbs., sausage casings 46 lbs., poultry 403 lbs., polony 164 lbs., pork 2,678 lbs.

Union of South Africa: Bacon 54,164 lbs., sausage casings 1,321 lbs., poultry 2,537 lbs.

Belgian Congo: Bacon 4,173 lbs., beef 116,612 lbs., offal 23,209 lbs., veal 355 lbs., sausage casings 567 lbs., poultry 990 lbs., polony 56 lbs., pork 13,501 lbs., mutton 201 lbs.

Bechuanaland Protectorate: Bacon 456 lbs., beef 5,618 lbs., sausages 190 lbs., offal 211 lbs., brawn 28 lbs.

Meat Products from Liebig's (Rhodesia) Ltd., West Nicholson.

Union of South Africa: Fats 8,610 lbs., Vienna sausages 330 lbs., neats foot oil 9 lbs., pate de foie 508 lbs.

Netherlands East Indies: Corned beef 18,000 lbs., fats 10,500 lbs., pate de foie 1,813 lbs.

PERCY D. HUSTON,
Chief Veterinary Surgeon.

SOUTHERN RHODESIA

Locust Invasion, 1932-46.

Monthly Report No. 170. January, 1947.

Red Locust: *Nomadacris septemfasciata*, Serv.

No reports of locusts in any stage of development within the Colony were received.

J. K. CHORLEY,
Chief Entomologist.

Rhodesian Milk Records.

OFFICIAL MILK RECORDS.

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Criterion Emma ...	Friesland	Senior 3 yrs	13097.00	463.85	3.54	300	J. Jamieson, Box 217, Bulawayo.
Bakenskraal Jeltje	Friesland	Junior 4 yrs	8297.00	279.01	3.36	300	
Bakenskraal Susanna	Friesland	Mature	13521.00	488.34	3.61	300	
Albert Vale Rosalie VIII.	Friesland	Mature	14230.00	488.47	3.43	300	
Whinburn Drongo	Friesland	Senior 3 yrs	9111.00	296.19	3.25	300	Major R. R. Sharp Whinburn, Redbank, Bulawayo
Whinburn Candy	Friesland	Mature	14124.70	469.69	3.33	300	
Whinburn Dopey	Friesland	Mature	9811.10	392.51	4.01	300	
Whinburn Amulet	Friesland	2 years	5964.40	231.81	3.89	300	
Whinburn Acorn	Friesland	2 years	7394.70	270.85	3.66	300	
Whinburn Alchemy	Friesland	2 years	5847.90	228.00	3.90	300	
Whinburn Amber	Friesland	2 years	7375.20	271.15	3.68	300	
Matopo Star	Red Poll	Junior 4 yrs	7449.50	286.33	3.84	300	Matopo School of Agriculture, Rhodes Matopo Estate, Bulawayo.
Matopo Quiz	Red Poll	Mature	12571.80	488.82	3.89	300	
Matopo Treasure...	Red Poll	Junior 3 yrs	7775.50	306.18	3.94	300	

SEMI-OFFICIAL MILK RECORDS.

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Annetta II.C.... ...	P.B. Friesland ...	Mature	8055.00	293.40	3.64	300	G. R. Anderson, Box 8, Gwelo.
Liva	G. Friesland	Mature	5948.00	234.67	3.95	282	R. A. Ballantyne, Box 801, Salisbury.
Rebecca	G. Friesland	Mature	6065.70	235.41	3.88	300	N. G. Barrett, Gavenny, Rusape.
Blue Bell	G. Shorthorn... ...	Mature	6475.70	290.79	4.49	300	J. H. Barry, Box 209, Umtali.
Caroline	G. Shorthorn... ...	Mature	5500.20	265.52	4.83	300	
Charter	G. Shorthorn... ...	Mature	7596.50	353.09	4.65	300	
Johanna	G. Shorthorn... ...	Mature	5539.20	240.21	4.34	300	
Market I.	G.L.R. Shorthorn	Mature	7575.40	275.92	3.64	300	
Very Nice I.	G. Shorthorn... ...	Mature	6148.80	249.60	4.06	300	

Donga II.	G. Friesland	Mature	5902.90	231.27	3.92	300	J. A. Baxter, Box 1368, Salisbury.
Leros	G. Friesland	Mature	6994.90	263.72	3.77	300	
Top	G. Friesland	Mature	6968.10	262.30	3.76	300	
Knife	G. Friesland	4 years	6151.40	256.81	4.17	300	
Peter	G. Friesland	Mature	6027.90	232.31	3.85	300	
Bruno...	G. Friesland	4 years	7119.60	269.86	3.79	300	
Dari	G. Friesland	Mature	6095.50	229.11	3.76	300	
Arthur	G. Friesland	Mature	6275.90	235.79	3.76	300	
Jessie	G. Friesland	Mature	8032.80	293.11	3.65	300	
Billions	G. Friesland	4 years	7576.10	287.58	3.80	300	
Fever...	G. Friesland	Mature	7040.30	268.32	3.81	300	
Marandellas	G. Friesland	Mature	6955.20	262.81	3.78	300	
Black	G. Friesland	Mature	7261.80	226.20	3.11	300	
Addis Ababa	G. Friesland	Mature	6478.40	229.29	3.55	300	
Moffu III.	G. Friesland	4 years	7521.10	396.90	5.28	300	J. R. Bedford, Poltimore, Marandellas.
Rainbow	G. Friesland	2 years	5934.30	273.63	4.57	300	
Kathleen	G. Friesland	2 years	6469.40	237.35	3.67	300	
Helenvale Josephine	P.B. Friesland ...	2 years	6034.70	245.66	4.07	300	A. L. Bickle, Box 595, Bulawayo.
No. D.5	G. Friesland	Mature	9246.90	394.57	4.27	291	
No. D.43	G. Friesland	3 years	8636.70	305.80	3.54	300	
No. D.61	G. Friesland	4 years	10292.40	442.43	4.29	300	
No. D.71	G. Friesland	4 years	10442.00	345.17	3.31	277	
No. D.72	G. Friesland	4 years	7665.80	289.98	3.78	300	
No. D.78	G. Friesland	4 years	8525.80	261.08	3.06	300	
No. D.101...	G. Friesland	3 years	9242.00	318.98	3.45	265	
No. D.105...	G. Friesland	3 years	7123.70	291.78	4.09	274	
No. D110...	G. Friesland	3 years	8624.20	307.60	3.57	300	
No. D.121...	G. Friesland	2 years	6061.90	233.18	3.84	300	
No. D124...	G. Friesland	2 years	6122.50	225.00	3.67	300	
No. J.37	G. Friesland	Mature	10266.40	346.71	3.38	300	
No. J.58	G. Friesland	Mature	10959.10	385.06	3.52	300	
No. J.67	G. Friesland	Mature	9447.30	312.12	3.30	300	
No. 6	G. Red Poll	Mature	5855.00	225.39	3.85	300	P. A. Bowen, Box 893, Salisbury.
No. 125...	G. Friesland	Mature	7252.00	267.34	3.69	300	C. Boyd Clark, Castle Zonga, Inyazura
Dirko Jill	P. Friesland	Mature	7097.00	289.15	4.07	275	
No. 135...	G. Friesland	Mature	9336.00	366.99	3.93	300	
Hilda...	G. Guernsey... ...	2 years	5516.20	239.50	4.34	280	Miss N. Brereton, Coolmoreen, Gwelo.

SEMI-OFFICIAL.—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Nancy	G. Ayrshire	Mature	5818.50	246.01	4.23	300	R. C. P. Cary, Clovelly, Trewlaney.
Rags	G. Ayrshire	Mature	6824.50	267.51	3.92	300	
Annabell	G. Friesland	Mature	6553.10	243.80	3.72	275	T. Cousins, Oaklands, P.B. Gwelo.
Sister...	G. Friesland	Mature	9366.60	298.91	3.19	281	
M'Nyati...	G. Friesland	Mature	7072.50	309.41	4.37	300	J. Cumming, Hillside Farm, P.O. Norton.
London	G. Friesland	Mature	7063.00	298.35	4.22	295	
Jumbo	G. Friesland	Mature	6671 50	259 51	3.89	300	
Sitoria	G. Friesland	Mature	7611.00	309.78	4.07	289	
Angelier...	G. Friesland	Mature	7694.90	289.42	3.76	300	Daisyfield Orphanage, P.O. Daisyfield.
Lena	G. Friesland	Mature	7768.70	312.57	4.02	300	
Maphosa	G. Friesland	Mature	8853.80	369.56	4.18	300	
Poppie	G. Friesland	Mature	6643.20	226.76	3.41	263	
Currents...	G. Friesland	Mature	7522.00	274.74	3.65	300	A. C. De Olano, Bluewater Farm, Bromley.
Mafunga II.	G. Friesland	Mature	7923.00	319.25	4 03	300	
Araminta	G. Friesland	Mature	10542.00	355.02	3.37	300	
Buttercup	G. Friesland	Mature	5961.00	262.15	4.40	268	
No. 121	G. Friesland	Mature	6775.30	280.65	4.14	300	J. B. Dold, Box 1153, Salisbury.
No. 80...	G. Friesland	Mature	6242.70	235.40	3.77	300	
Betty	G. Friesland	Mature	8716.00	337.24	3.87	298	Mrs. M. Everard, Castle Zonga, Inyazura.
No. 71...	G. Friesland	Mature	9422.00	321.12	3.41	300	
Eight...	G. Friesland	Mature	6266 00	280.07	4.47	300	H. W. Filmer, Penkridge West, P.B. Umtali.
No. 223	G. Friesland	Mature	7360.00	278.95	3.79	300	H. C. Fischer, Olivia Farm, Headlands.
No. 279	G. Friesland	Mature	6253.00	230.09	3.68	272	
No. 39	G. Friesland	4 years	8750.00	295.43	3.38	280	R. le S. Fischer, Wakefield, Headlands.
No. 57	G. Friesland	3 years	8881.00	281.44	3.17	300	
No. 76	G. Friesland	3 years	10018.00	348.61	3.48	284	
No. 102...	G. Friesland	2 years	8059.00	269.28	3 34	300	
No. 105...	G. Friesland	2 years	8057.00	273.03	3.39	274	

No. 107...	G. Friesland	2 years	10221.00	354.80	3.47	277	
No. 111...	G. Friesland	2 years	11235.00	338.63	3.01	300	
No. 140...	G. Friesland	2 years	6631.00	241.72	3.65	300	
No. 157...	G. Friesland	Mature	9907.00	344.39	3.48	300	
No. 189...	G. Friesland	Mature	10996.00	375.60	3.42	300	
No. 356...	G. Friesland	Mature	8468 50	292.31	3.45	285	W. F. Fischer, Coldstream Dairy, Headlands.
No. 384...	G. Friesland	Mature	8869.00	289.20	3.26	300	
No. 395...	G. Friesland	Mature	9356 50	392.45	4.19	300	
No. 429...	G. Friesland	Mature	6011.00	228.23	3.80	300	
No. 458...	G. Friesland	4 years	6052.50	225.81	3.73	278	
No. 470...	G. Friesland	4 years	6824.00	287 83	4.22	300	
No. 480...	G. Friesland	4 years	6029 50	254 97	4 22	259	
No. 549...	G. Friesland	2 years	7252.00	280.30	3.87	300	
Claisen	G. Shorthorn... ...	Mature	8134.30	313.69	3.86	247	G. J. Franklin & Son, Box 105, Umtali.
Daisy Bell	G. Friesland	Mature	7235.00	246.32	3.40	251	
Feetie I.	G. Friesland	Mature	6764.50	318.61	4.71	300	
Ganganda III. ...	G. Friesland	4 years	5120.70	267.40	5.22	300	
Jam	G. Friesland	Mature	12027.10	476.32	3.96	300	
Kudada	G. Friesland	Mature	6701.70	255.51	3.81	300	
Nancy II.	G. Friesland	Mature	7282.60	359.77	4.94	300	
Nora	G. Guernsey... ...	Mature	5996 40	228.11	3 86	275	
Phoebe	G. Friesland	Mature	12528.20	514.28	4.11	300	
Phyllis	G. Friesland	Mature	9749.90	333.11	3.42	300	
Sandy	G. Friesland	Mature	8057.70	275.04	3.41	300	
Shandy	G. Friesland	Mature	6127 80	263.89	4.31	300	
Silk	G. Friesland	Mature	6951.70	285.12	4.10	233	
Thipiri II....	G. Friesland	4 years	8396.80	364.17	4.34	300	
Zea	G. Friesland	2 years	6296 90	232.17	3.69	300	
Contract II.	G. Friesland	Mature	8036.90	287.23	3.57	300	P. Freeland, Lingfield. P.O. Gwelo.
Beatrice	G. Friesland	Mature	6308.00	246.76	3.91	261	Hon. H. V. Gibbs, Bonisa, P.B. 52L, Bulawayo.
Ducky...	G. Friesland	3 years	6436.00	235.83	3.66	234	
Emma	G. Friesland	Mature	8241.00	286.77	3 48	289	
Grace...	G. Friesland	Mature	8374.00	284.19	3.39	300	
Harriet	G. Friesland	4 years	6965.00	262.50	3.77	300	
Maria...	G. Friesland	Mature	8221.00	247.85	3 01	287	
Nella	G. Friesland	3 years	5820.00	273.27	4 69	300	
Pearl	G. Friesland	Mature	7851.00	258.61	3.29	286	
Rhoda...	G. Friesland	Mature	7148.00	259.99	3.63	300	
Nyeta	G. Common	Mature	5732.80	262.89	4.58	300	C. A. G. Gourlay, Box 244, Umtali.

SEMI-OFFICIAL.—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Buffalo	G. Friesland	Mature	8617.50	285.96	3.32	284	Gwebi Govt. Farm, P.B. 76B, Salisbury
No. 15...	G. Friesland	Mature	13996.70	477.57	3.41	300	Grasslands Experimental Station, Marandellas.
No. 3	G. Friesland	Mature	11318 00	451.01	3.91	300	
No. 11...	G. Friesland	Mature	10703.40	381.62	3.57	279	
No. 2	G. Friesland	Mature	13447.20	492.89	3.67	300	
No. 10...	G. Friesland	Mature	11498.60	350.58	3.05	300	
No. 9	G. Friesland	Mature	12538.90	387.88	3.10	300	
No. 29...	G. Friesland	Mature	10693.00	378.81	3.53	280	
No. 28...	G. Friesland	Mature	12515.20	462.90	3.70	300	
No. 46...	G. Friesland	3 years	6918.50	233.06	3.37	300	
No. 47...	G. Friesland	3 years	8871.00	286.93	3.23	300	
No. 22...	G. Friesland	4 years	10765.10	355.69	3.31	300	
No. 43...	G. Friesland	3 years	11086.30	414.40	3.74	300	
No. 42...	G. Friesland	3 years	10285.40	323.60	3.15	300	
Wendy	G. Guernsey/Friesland	Mature	5809.20	288.00	4.96	300	D. A. Harley, Harleyton, Beatrice.
Nancy II.	G. Guernsey/Friesland	Mature	5558.10	258.45	4.65	300	
Amy	G. Guernsey... ...	Mature	7225 30	314.87	4.36	300	
Ethel	G. Guernsey... ...	Mature	6348.30	277.45	4.37	300	
Breakfast	G. Guernsey... ...	Mature	10316.60	402.57	3.90	300	Est. late A. J. Harley, Newton, Marandellas.
No. 2...	G. Guernsey... ...	4 years	5914.50	234.74	3.97	262	
Malkop	G. Guernsey... ...	Mature	5357.20	249.07	4.65	234	
Whiteback...	G. Guernsey... ...	Mature	5554.90	253.80	4.57	251	
Lucy	G. Guernsey... ...	3 years	9252.30	445.15	4.81	300	Mrs. L. M. H. Howard, Nengwa Farm, Beatrice.
Bessie	G. Friesland	Mature	5879.70	244.22	4 15	300	D. J. Huddy, Box 718, Salisbury.
Vixen...	G. Friesland	Mature	7254.40	268.52	3.70	300	
Maisie	G. Friesland	3 years	5996.10	244.12	4.07	300	
Piccanin...	G. Friesland	4 years	6072.90	274.25	4.52	293	
Belinda...	G. Friesland	3 years	7323 70	293.52	4.01	300	
Biscuit	G. Friesland	2 years	5795.10	249.61	4.31	300	

Witklap II.	G. Friesland	Mature	7696.40	293.62	3.82	239	
Lulu	G. Friesland	3 years	7080 90	247.46	3.49	300	
Flivver	G. Friesland	Mature	7910.70	314.32	3.97	300	
Moscow	G. Friesland	Mature	8434.70	288.34	3.42	282	
Mandala...	G. Friesland	Mature	7372.30	297.98	4.04	300	L. Huddy, Amalinda, Salisbury.
Gundaan	G. Friesland	Mature	6628.70	265.22	4.00	300	
J.18/1...	G. Friesland	2 years	9137.00	372.74	4.08	300	J. Jamieson, Box 217, Bulawayo.
J.25/1...	G. Friesland	2 years	7846.00	305.86	3.90	300	
J.28/1...	G. Friesland	4 years	11819.00	446.97	3 87	300	
J.36/1...	G. Friesland	3 years	7384.00	245.64	3.33	300	
J.41/1...	G. Friesland	2 years	8283.00	314.81	3.80	300	
J.J.48/2	G. Friesland	3 years	8566.00	352.59	4.12	300	
J.49/1...	G. Friesland	4 years	13503 00	482.59	3.57	300	
J.J.54/1	G. Friesland	4 years	13863.00	571.71	4.13	290	
J.56/1...	G. Friesland	4 years	15638.00	530.28	3.39	300	
J.64/1...	G. Friesland	4 years	12113.00	454.14	3.75	300	
J.66/1...	G. Friesland	Mature	9907.00	356.53	3.60	300	
J.66/1/1	G. Friesland	2 years	9320.00	360.96	3 87	300	
J.71/2...	G. Friesland	2 years	8975.00	341.89	3.81	300	
J.J.130	G. Friesland	4 years	11863.00	367.64	3.10	300	
J.J.157	G. Friesland	Mature	15086 00	640.51	4.25	300	
J.J.179	G. Friesland	Mature	13593.00	465 88	3.40	258	
J.J.185	G. Friesland	Mature	8452.00	311.41	3.68	263	
J.J.190	G. Friesland	Mature	13594.00	465.88	3.40	258	
D.14...	G. Friesland	Mature	9030.00	324.94	3.59	300	B. H. Kew, Box 972, Bulawayo.
Maggie (Monkey Nuts)	G. Friesland	Mature	8363.30	291.29	3.48	297	H. Knill, Mendamu, Marandellas.
Clementine...	G. Friesland	3 years	6834.10	257.01	3.76	300	
Jennifer II.	G. Friesland	3 years	7065.10	251.60	3.56	300	
Charmaine...	G. Friesland	3 years	5487.50	237.67	4.41	300	Mrs. M. Krahner, Haydock Park, Banket.
Moonshine...	G. Friesland	Mature	7383.50	264.12	3.58	300	
Annie	G. Friesland	Mature	5933.40	244.75	4.12	262	
Skea II.	G. Friesland	Mature	6750.00	302.16	4 48	300	P. Linton, Box 898. Salisbury.
Lawyer IV.	G. Friesland	Mature	7513.30	225.86	3.01	300	
Red Valley...	G. Friesland	Mature	8213.60	270.98	3.30	300	
Fichaan...	G. Friesland	Mature	8025 50	274.05	3.41	300	
Barney	G. Friesland	Mature	9634.00	327.93	3 40	300	
Butterfly	G. Friesland	Mature	7606.00	262.28	3.45	300	
Hat	G. Fries-Hereford	Mature	7335.90	300.90	4.10	300	
Mapfumo	G. Friesland	Mature	7050.80	270.77	3.84	300	
Maisie...	Common Grade...	Mature	7258.00	249.32	3.44	295	J. Mares, Juliasdale, P.B. Umtali.

SEMI-OFFICIAL.—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
No. 120	G. Friesland	Mature	7750.20	279.26	3.60	300	D. W. Marshall, Box 164, Umtali.
No. 174...	G. Red Poll	3 years	8148.10	341.70	4 19	300	Matopo School of Agriculture, P.B. K19, Bulawayo.
No. 189...	G. Red Poll	2 years	5474.70	239.87	4.38	300	
Jabi	G. Jersey	4 years	6912.70	294.65	4.26	300	Colonel C. I. F. Maynard, P.B. 112C, Salisbury.
Manuchi...	G. Jersey	4 years	5056.90	243.64	4.82	300	
Barbari	G. Jersey	2 years	4473.10	232.98	5.21	300	
No. 332...	G. Guernsey/ Friesland	Mature	9767.40	307.91	3.15	271	J. R. McLaren, Safago, P.B. Gwelo.
No. 400...	G. Guernsey/ Friesland	4 years	6967 90	287.82	4.13	228	
No. 438...	G. Guernsey	3 years	6690.90	264.50	3.95	254	
Bucket	G. Red Poll	Mature	5831.60	246.81	4.23	300	J. H. McLean, Box 161, Gwelo.
Jersey	G. Jersey	Mature	5881.60	257.84	4.33	300	
P.14/0	P.B. Friesland ...	Mature	6293 00	247.46	3.93	292	Meikle Bros., Leachdale Farm, Shangani.
P.18/0	P.B. Friesland ...	Mature	7554.00	257.83	3.41	300	
15/7	P.B. Friesland ...	Mature	7410.00	250.50	3.52	300	
26/7	P.B. Friesland ...	Mature	9191.00	323.21	3 52	300	
P.36/9	P.B. Friesland ...	Mature	8802.00	322.80	3.67	300	
G.3/0	G. Friesland	Mature	8230.00	322.35	3.92	300	
G 3/2	G. Friesland	3 years	8833.00	304.47	3.45	300	
17/7	G. Friesland	Mature	10925.00	363.51	3 33	300	
20/8	G. Friesland	Mature	11061.00	414.62	3.75	300	
6/9	G. Friesland	Mature	10761.00	340.53	3.17	300	
No. 140...	G. Friesland	Mature	9608.00	358.81	3.74	300	
Jagger	G. Red Poll	Mature	5370.20	239.57	4.46	300	Capt. B. L. Miles, Muneni, P.O. Banket
Mary	G. Friesland	Mature	4291.30	237.27	5.53	275	Mitchell & Harvey, Argyll, Odzi.
Friesia	G. Shorthorn... ...	Mature	5979.60	232.67	3.89	300	C. Moorhouse, Odzi Drift, Umtali.
Quality	G. Ayrshire	Mature	6555 50	263.08	4.01	300	Commander E. L. Morant, Box 741, Salisbury.
Natty...	G. Red Poll	Mature	7741.70	270.82	3 50	300	
Lavender...	G. Ayr/S. Devon	Mature	5490.60	251.43	4.58	300	
Mrewa	G. Friesland	Mature	6020.50	243.65	4 05	300	

Maisie	G. Ayrshire	Mature	7142.40	269.52	3.78	300	
Molly	G. Ayrshire	Mature	6435.50	253.48	3.94	300	
Cherry	G.L.R./Shorthorn	Mature	6493.80	255.53	3.93	238	G. R. Morris, Box 1040, Salisbury.
Grace	G. Guernsey	Mature	5997.90	227.60	3.79	300	
No. 40	G. Friesland	Mature	9434 00	291.56	3.09	300	F. B. Morrisby, Sunnyside Farm, Gwelo.
No. 147	G. Friesland	Mature	6693.00	259.51	3.88	262	
Mota	G. Shorthorn	Mature	7931.50	334.88	4.22	300	F. Muggleton, Steynstroom, Umtali.
June	G. Friesland	Mature	6813.80	327.99	4.81	300	J. T. Mungle, Myreside, Odzi.
Ossak	G. Friesland	Mature	6456.30	276.96	4.29	300	
Raisen	G. Red Poll	Mature	6102.50	283.32	4.64	300	
Grace	G. Friesland	Mature	7223.00	266.71	3.69	300	Mutambara Mission, P.O. Mutambara.
Emma	G. Friesland	4 years	6035.00	290.53	4.81	280	
Bella I.	G. Friesland	Mature	7848.00	281.35	3.59	300	C. C. Neill, Box 190, Gwelo.
Mabel	G. Friesland	Mature	6023.00	226.46	3.76	300	
Rosette	G. Friesland	Mature	9351.00	294.80	3.15	300	
Edward	G. Friesland	3 years	7367.00	329.91	4.48	300	K. Norvall, Box 637, Bulawayo.
Katang	G. Friesland/Afrikander	Mature	5534.00	259.88	4.69	300	
Bell	G. Friesland	Mature	13218.10	433.31	3.28	300	E. Palmer, Ferndale, Penhalonga.
Maisie II.	G. Shorthorn	3 years	6529 30	264.24	4.05	262	
No. 201	G. Friesland	Mature	5121.40	250.61	4.89	300	T. C. Pascoe, Box 1253, Salisbury.
No. 97	G. Friesland	Mature	8542.60	295.44	3.46	300	
Crowborough Swanee	P.B. Friesland	2 years	6588.50	232.65	3.53	300	
Gundwani	G. Friesland	2 years	7399.50	235.07	3.18	300	Mrs. Worthington Reed, Box 19, Gwelo
Lily	G. Friesland	2 years	7599.20	255.01	3.36	300	Rhodesian Corporation, Ltd., Kent Estate, Norton.
Barbara	G. Friesland	2 years	6874.50	260.51	3.79	300	
Nimble	G. Friesland	2 years	5915.70	233 45	3.95	300	
Molly II.	G. Friesland	Mature	6595.70	227.70	3.45	300	
Imp	G. Friesland	Mature	7025.20	252.78	3.60	300	
Lioni	G. Friesland	Mature	5524.20	238.43	4.32	269	W. F. H. Scutt, Maple Leaf, Norton.
Zelesa	G. Friesland	Mature	9545.50	300.63	3.15	273	
Siliva	G. Friesland	4 years	6301.40	227.18	3.61	300	
Avoca	G. Friesland	Mature	9750.90	336.01	3.45	300	

SEMI-OFFICIAL—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner
Sophie	G. Red Poll	Mature	6636 20	243 37	3.67	300	K. M. Simpson, Mandara Farm, Box 96, Salisbury.
Marigold...	G. Red Poll	Mature	6966.20	243.35	3.50	300	
Bella	G. Friesland	Mature	5964.50	244.44	4.09	300	Mrs. V. Stead, Box 56 Gwelo.
Blanco	G. Friesland / Guernsey	Mature	6121.50	246.09	4.02	300	
No. G.2	G. Ayrshire	Mature	7241.50	256.03	3.53	300	J. R. Stewart & Sons, Ltd., Battle Farm, Shangani.
No. G.17	G. Ayrshire	4 years	6152.50	225 14	3.66	325	
Sofa	G. Friesland	4 years	6596.50	239.96	3.64	300	Susman & Newfield, Box 323, Salisbury.
Susan...	G. Friesland	Mature	5752.50	272.87	4.74	300	
Ring	G. Friesland	Mature	7901.00	240.53	3.04	300	Evelyn Tapson Trust Ltd., Lesape Falls, Rusape.
Girida I....	G. Ayrshire	Mature	7454.00	264.83	3.55	300	
Mudzeke	G. Friesland	4 years	8201.00	257.24	3.14	300	
Spider	G. Friesland	4 years	7013 00	287.50	4.10	300	
Piccanin	G. Friesland	4 years	6759.00	265.81	3.93	300	
Blacke...	G. Friesland	2 years	7772 00	306.44	3.94	300	
Ngorego	G. Friesland	4 years	7047.00	273.27	3.88	271	
Darwin	G. Friesland	4 years	7505.00	310.76	4.14	300	
Gumbo	G. Friesland	Mature	6050.00	286.01	4.73	300	
Separator	G. Friesland	2 years	5070.00	231.78	4.57	300	
Caroline	G. Friesland	3 years	6557.00	281 58	4.29	289	
Gracie	G. Friesland	2 years	5738.00	234.84	4.09	271	
Gunda	G. Ayrshire	3 years	6507.00	245 43	3.77	279	
Eginya	G. Ayrshire	Mature	5569.00	235.81	4.23	278	
Julia	G. Ayrshire	Mature	7471.00	275.35	3.69	266	
Djonifa II.	G. Ayrshire	Mature	8370 00	361.48	4.32	247	
Shortone...	G. Friesland	Mature	6937 50	263.45	3.80	300	A. W. Tennent, Kelvin, Headlands.
Boy...	G. Friesland	Mature	6129 20	240.80	3.93	300	
Nellie	G. Friesland	Mature	7425.40	264.30	3.56	300	
Sabina	G. Friesland	Mature	7931 00	278.25	3.50	273	W. E. Tongue, Box 199, Bulawayo.
Cressydale Topaz	P.B. Red Poll ...	Mature	7388.00	270.57	3.66	300	A. M. Tredgold, P.B. 61L, Bulawayo.
No. L.18	G. Red Poll	Mature	6248.00	246.37	3.94	300	
No. T.B.58	G. Red Poll	Mature	6121.50	238.52	3.89	300	
No. 114...	G. Red Poll	Mature	6884.50	291.66	4.24	300	
No. 127...	G. Red Poll	Mature	6285.50	281.44	4.48	300	
No. 131...	G. Red Poll	Mature	7541.50	261.07	3.47	300	
No. 165...	G. Red Poll	Mature	7193.50	271.59	3.78	300	
No. 186...	G. Red Poll	4 years	5373.00	232.04	4.31	300	
No. 192...	G. Red Poll	4 years	5539.50	230.84	4.17	300	
No. 211...	G. Red Poll	3 years	6404.50	257.79	4.03	300	
No. 215...	G. Red Poll	4 years	6142.50	231.30	3.77	300	

THE RHODESIA

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Editorial

Notes and Comments

THE DISADVANTAGES OF HILLING MAIZE.

"It is not necessary to remove the suckers from growing maize crops. This practice, adopted by many farmers with the idea of increasing yield and incidentally providing a little fodder for stock, actually decreases the yield, as proved by an experiment conducted at Grafton Experimental Farm over a period of four years."—("Agricultural Gazette," New South Wales, December, 1946.)

DAIRY BONUS SCHEME 1946-47.

In view of the drought it has been decided that the production requirements under the Dairy Bonus Scheme should be maintained for this season at the same level as last year, viz., with the exception of the standard for the first year which will remain at 125 lbs. of butterfat. the requirements for second and third year participants will be lowered respectively to those of the first or second year. The standards will therefore be as follows:—

Existing Standards	Standards for the Current Season.
First Year—125 lbs. Butterfat.	125 lbs. Butterfat.
Second Year—150 lbs. Butterfat.	125 lbs. Butterfat.
Third Year—175 lbs. Butterfat.	150 lbs. Butterfat.

THREE USEFUL LEGUMINOUS FODDER TREES.

This is the title of an article of particular interest to farmers in low rainfall areas. The trees described are the Mesquite or Prosopis Tree, the Honey Locust or Gleditsia Tree and the Carob or Locust Bean. In South Africa the Mesquite Tree seldom exceeds thirty feet in height as it is usually planted in poor infertile soil. Once established its average height growth is from 1-3 feet per year. It is cultivated mainly for the pods, which have a high nutritional value, the pods being relished by horses, cattle, donkeys, sheep, pigs, etc. Under very favourable conditions the tree starts bearing from the fourth or fifth year and from its tenth year it can be expected to yield 200 lb. of pods. The pods should be collected immediately they drop off and stored in a dry place. The seeds. which should be soaked in very hot water for about 24 hours and allowing the water to cool, may be sown directly in well prepared soil or raised in tins in a nursery. The plants should be set out at an espacement of 20 feet.

The Honey Locust or Gleditsia Tree is found in many parts of the Union as an ornamental, shade or fodder tree. It is frost and drought resistant. As it is inclined to put out suckers it can be planted in dongas to control erosion. The pod yield differs and it may therefore be necessary to graft or bud to produce high yielding trees. From the seventh to twelfth year up to an average yield of 500 lb. of dried pods of high nutritional value may be expected. As in the case of Mesquite, seeds must be soaked and the same espacement is recommended.

The Carob is grown mainly for its pods, which contain a high percentage of sugar and other digestible materials. For feeding to animals other than pigs the pods, after being crushed, should be mixed with hay, grass or oats. The seed should be soaked in boiling water and then sown in situ, as the young plants do not transplant well.

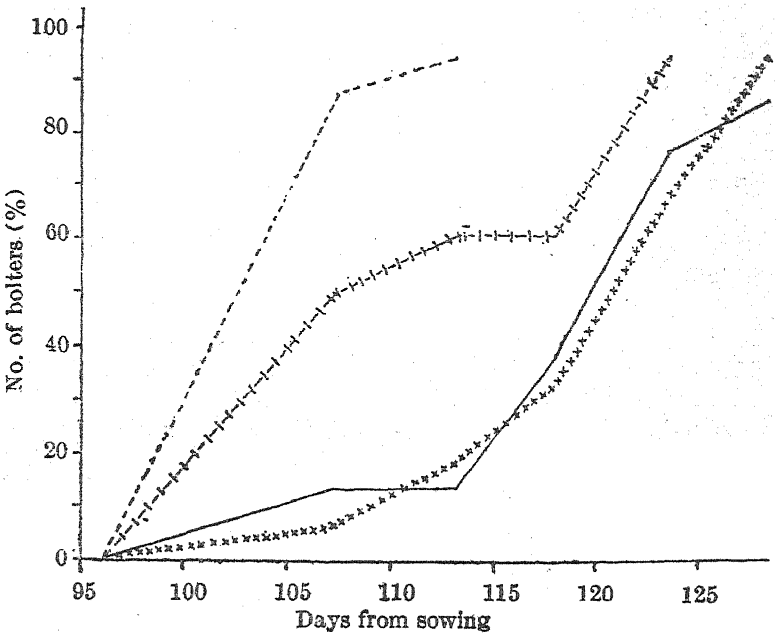
(In Southern Rhodesia results with Carob Bean are frequently poor and are usually better at lower altitudes.—Ed.)

—["Farming in South Africa," January, 1947.]

VERNALIZATION OF LETTUCE.

Experiments conducted in the Botany Department of Manchester University have shown the importance of vernalization treatments. Four sets of Feltham King Lettuce were sown out of doors on April 8. One set of seed (S) was soaked for 24 hours before sowing while set (SX) was soaked 72 hours, by which time germination had commenced and the radicles were visible. A further two sets (V and VX) were similarly treated and in addition were kept at 0—4° C for 24 days before sowing. These four sets were sown together, germination was successful and apparently at the same rate all formed hearts at the same time. Appreciable differences were evident, however, in the rate at which "bolting" occurred. No set showed signs of "bolting" before July 20th and

the graph below shows the percentage of bolters in each set after this date On July 30th the bulk of the V plants were 45-60 cm. high and the VX plants 15-18 cm., while a few S. and SX plants were just showing evidence of bolting. Flowering dates were as follows:—V plants, 28th August; VX plants, 2nd September; S and SX plants, 1st October. The vernalization treatment of the



swollen seed accelerated flowering by thirty-one days. This great acceleration may have been partly due to unfavourable weather during September which retarded the flowering of S and SX plants

The important point noted was that the vernalization treatment given after the radicle emerged was so much less effective than the treatment carried out after the seed had swollen for only 24 hours and before germination occurred. The importance of timing any vernalization treatments is also stressed.—("Nature," January 4, 1947.)

Annual Milking Competition, 1945 - 1946.

The Southern Rhodesian Annual Milking Competition, which has been held for the past 15 years, is open to all farmers whose herds are tested under the Government Milk Recording Scheme, other than those who supply milk for the fresh milk trade.

The competition is divided into two separate competitions, one based on the highest average quantity of milk produced by the best 15 cows in the herd, and the second competition on the highest average quantity of butter-fat produced by the best 15 cows in the herd.

Messrs. Meikles Trust & Investment Co., Ltd., Leachdale Farm, Shangani, who are the winners this year of the competition for the highest average quantity of milk produced, are to be congratulated for the very creditable record of 11,860 lbs. of milk per cow, which means that each cow of the 15 winners in the herd produced just under four gallons of milk daily during the 300-day milking period.

Messrs. Meikles Trust & Investment Co., Ltd., have won this competition for seven or eight years in succession in addition to winning the butter-fat competition on at least four consecutive occasions.

The second and third prize-winners in this competition, the Grassland Experiment Station at Marandellas and Mr. Rijk le S. Fischer, of Headlands, are also to be congratulated upon the very fine records set up, which fall only just below the figures returned by the winning 15 cows of Messrs. Meikles Trust & Investment Co., Ltd.

For the second year in succession the Grassland Experiment Station at Marandellas has been the winner of the butter-fat competition. In this case the very creditable average of 429 lbs. of butter-fat was produced by each of the 15 winners in the herd. In terms of commercial butter, each cow produced just under 520 lbs. during the 300-day milking period.

The full results of the two competitions are as follows:—

Competition "A" (for the 15 cows with the highest average milk production in a lactation not exceeding 300 days)—

	Lbs.
1st—Thos. Meikle Trust & Investment Co., Ltd., Leachdale, Shangani: Average production of milk per cow	11,860.0

A glimpse of a few of the Frieslands at the Grasslands Experimental Station, Marandellas.

	Lbs.
2nd—Grassland Experiment Station, Marandellas: Average production of milk per cow	11,789.7
3rd—R. le S. Fischer, Wakefield, Headlands: Average production of milk per cow	11,077.7

Competition "B" (for the 15 cows with the highest average butter-fat in a lactation not exceeding 300 days)—

1st—Grassland Experiment Station, Marandellas: Average production of butter-fat per cow	429.07
2nd—Meikles Trust & Investment Co., Ltd., Leachdale, Shangani: Average production of butter-fat per cow	389.00
3rd—R. le S. Fischer, Wakefield, Headlands: Average production of butter-fat per cow	372.83

Letting Machines do it.

Farm Drainage Work Mechanised.

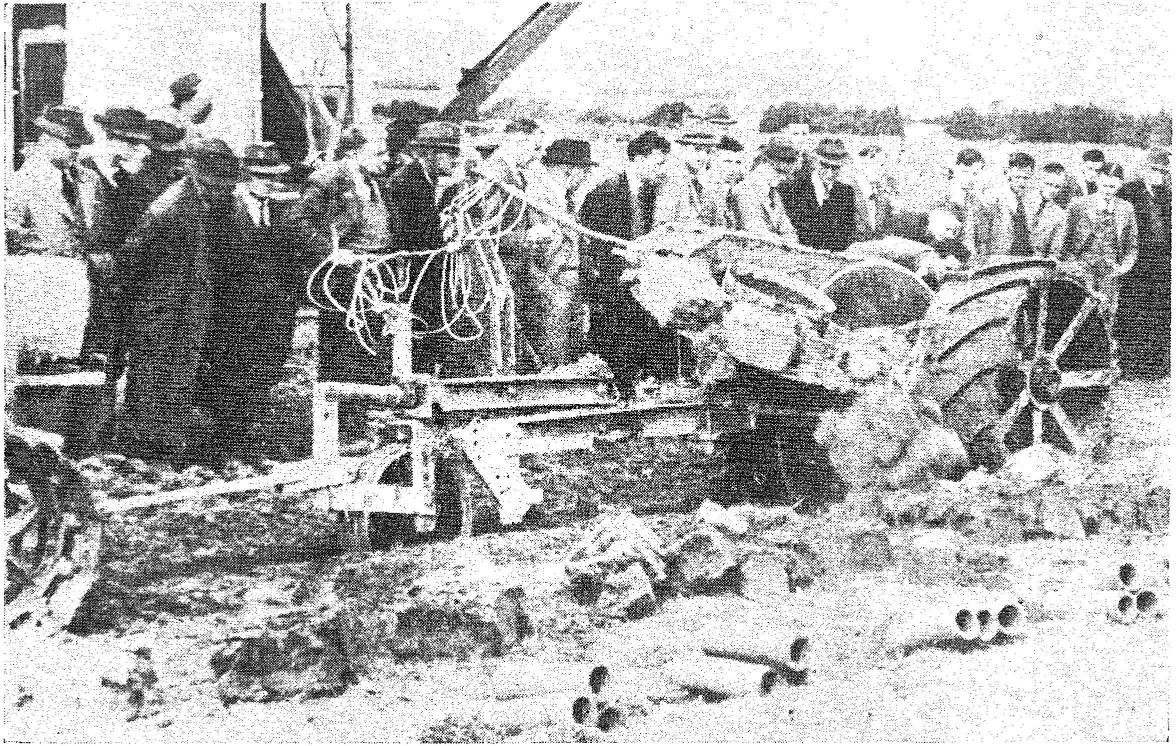
By L. A. G. BARRETT, Massey Agricultural College, New Zealand.

Thousands of acres of New Zealand's swamp lands have prospects of being made productive through adequate drainage. Many more thousands of acres of farm lands already settled are in need of relief from excess water, which by its persistence encourages the growth of rushes and other wet-footed plants in place of good pastures.

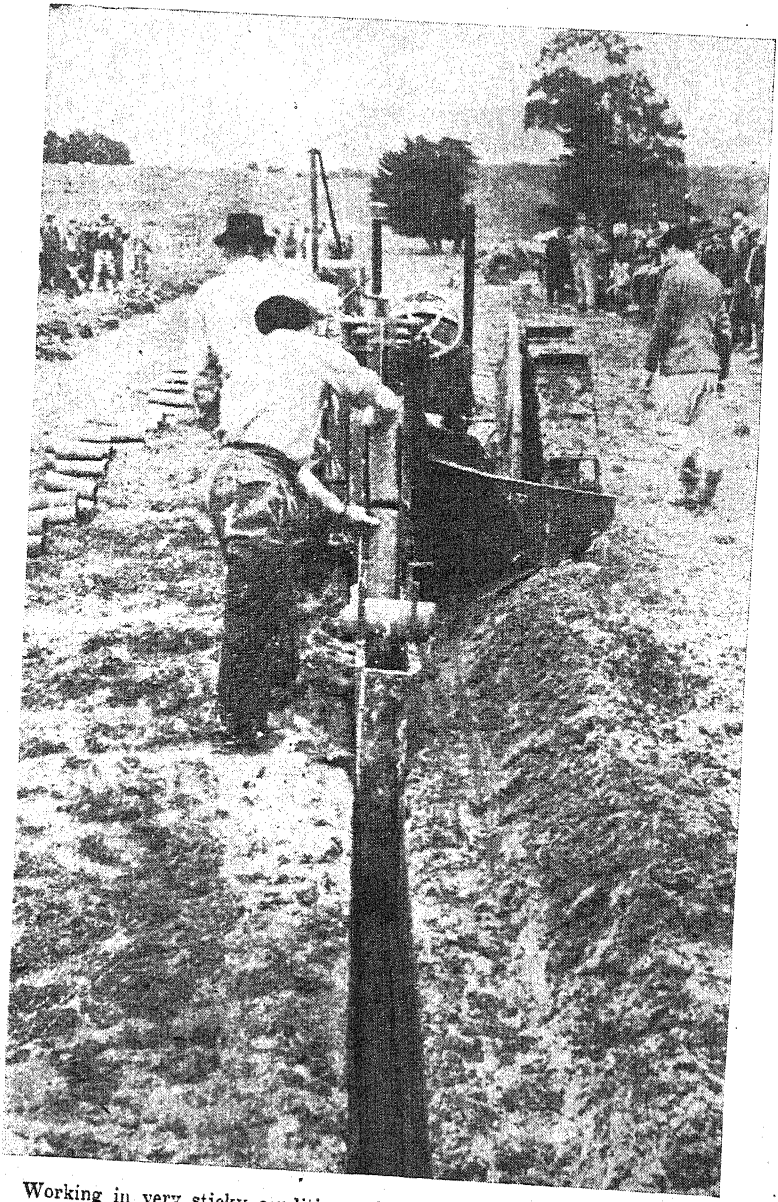
Economical means whereby this transformation might be brought about, and the production from large tracts of country almost doubled, were suggested by a demonstration of many new types of farm drainage machinery at Massey Agricultural College (N.Z.) recently. Some 1,700 people saw there in action a combined trench-digging and tile-laying machine, with an angle-dozer for back-filling the trench; two ditching machines of New Zealand design, at least one of which will probably prove of interest overseas; a side dragline for cleaning open drains; a special type of metal tractor wheel for supplementing the grip of rubber tyres in soft country; two mole drainage ploughs controlled from the seat of the tractors, one by a rope and the other by hydraulic lift; and an ingenious device whereby a tile can be drawn into the outlet of a mole drain during its formation.

Chief interest focussed on the Roteho machine, which combines the two functions of digging a trench and laying tiles in one operation. It was designed and brought into production in England during the war years, and only recently has been taken off the secret list. The reported results in England appeared to be so promising that the Massey College authorities imported a machine for demonstration purposes, with a view to encouraging the use of machinery for tile drainage work on farms. The work done at the demonstration, where the machine travelled a chain in six minutes, revealed its possibilities for many types of country on New Zealand.

Designed on the rotary hoe principle, the implement comprises a wheel about four feet in diameter fitted with hoe blades. As the machine moves forward, the blades rotate and the hoes bite



The action of two vertical discs brings about this result.



Working in very sticky conditions, the Roteho has dug its trench and laid the tiles neatly along the bottom.

into the soil, carrying the displaced earth to a chute which lays it clear of the trench, the standard width of which is seven inches, though the depth can be varied from 20 to 36 inches. By the aid of remote controls the driver can steer the tractor, and, through use of sighting rods, can regulate the depth of the trench within the 12 inches of tolerance allowed by the machine. In second gear, 10 chains of tiles can be laid in an hour.

Before operation, tiles are laid out in small heaps along the course of the proposed drain. A chute-like attachment to the machine above ground level is used for placing the tiles by hand. The machine eases them into the bottom of the trench, where they are made more compact by a roller fitted to their shape.

Home-Designed Ditch-Digger. Another machine with definite prospects for wide use in New Zealand and overseas was a ditch-digger designed by Mr. Guy Lewis, an Alfredton (Wairarapa) farmer, who has worked it successfully in rough, bush-burn country. Although to the inexperienced eye it might have what the designer himself described as a "Heath Robinson" appearance, the machine is an ingenious affair with no delicate mechanism to be jolted out of position. Combining the principles of the plough, the disc and the trip release, it will cut and throw clear slices of soil some 11 inches wide and eight inches deep. Three cuts at ordinary tractor speed will excavate a trench two feet deep and nearly a foot wide—leaving a trench ready for tile-laying, or the makings of an open farm drain into which tile or mole channels can be led.

This New Zealand invention comprises two discs five feet in diameter, spaced 11 inches apart, and mounted on a stout frame, behind which are two very wide wheels to distribute the weight in soft going. In operation, the discs cut a slice of soil eight inches deep, and this remains between the revolving discs until, at the top of the circumference, a scraper ensures that the slice slides on to a single disc, which revolves because of the weight of soil, and the soil is thrown well clear of the wide, following wheels. The cutting share is protected by the two discs, which tend to ride over any obstacle too tough to cut through.

The second ditching machine, also a product of Wairarapa ingenuity, consists of a U-shaped cutter mounted on a frame. As the machine is let into the ground, the cutter severs a slice which is carried to the surface on a long slide, and deposited on one side of the trench by a crowder. Five or six cuts are necessary for the formation of a tile drain two feet deep.

The Bower wheel, for improving the drawing power of rubber-tyred tractors, was widely used in England during the war. A unit has been presented to Massey College for demonstration purposes. Basically, it comprises a heavy casting which carries a series of spokes, each ending in a paddle blade. The casting can remain bolted to the tractor, and the spokes can be extended quickly beyond the tyre to give extra grip.

The demonstrations were attended by farmers from as far afield as North Auckland and Southland.

The Southern Rhodesian Wheat Crop 1946.

By P. FULLER, Chemist, The Rhodesia Milling & Manufacturing Co., Ltd., Bulawayo.

MIDLANDS DISTRICT.

Enkeldoorn, Umvuma, Chatsworth, Gutu and Fort Victoria.

The first truck of wheat was received on October 10th and by December 31st 21,600 bags were received.

The average figures were:—

		1945.	1944
Bushel Weight ...	65¼ lbs.	64½ lbs.	64½ lbs.
Kernel Weight ...	38.35 grams	37.37 grams	37.00 grams
Moisture	9.01%	11.65%	10.00%
Protein...	10.25%	10.44%	9.73%

Grading. Only one lot of wheat was under grade this year; 91 bags weighing 61½ lbs. due to screening; 0.4%.

Moisture. 199 samples were tested for moisture. All the wheat was dry, with the following distribution:—

			1945.	1944.
6- 7%	20 samples ...	10%	—	—
7- 8%	27 samples ...	13.59%	—	—
8- 9%	30 samples ...	30.15%	2.20%	—
9-10%	49 samples ...	24.62%	5.19%	39.8%
10-11%	33 samples ...	16.58%	23.69%	21.1%
11-12%	10 samples ...	5.02%	33.43%	32.6%
Over 12%	—	—	21.10%	6.5%
Over 13%	—	—	14.50%	—

Protein Content. Protein figures were low again this year. This is a big fault with Rhodesian wheat. For satisfactory bread production high protein contents are needed.

208 samples were tested with the following results:—

			1945.	1944.
Less than 8%...	2 samples		—	5.50%
8- 9%...	25 samples ...	13.6%	1.77%	20.9%
9-10%...	80 samples ...	38.4%	32.88%	40.1%
10-11%...	72 samples ...	34.6%	37.77%	18.5%
11-12%...	22 samples ...	10.6%	18.66%	13.0%
Over 12%	7 samples ...	3.3%	8.00%	1.8%

These figures should be compared with protein figures on samples from the Government Plant Breeding Station.

Kernel Weights. 205 samples were counted.

			1945.	1944.
Less than 30 grams	2 samples		—	—
30-35 grams	74 samples	37.07%	23.89%	27.00%
35-40 grams	87 samples	42.44%	52.65%	56.30%
Over 40 grams	42 samples	20.49%	23.45%	17.60%

Varieties Grown. From information received from growers the following varieties were grown this year:—

	No. of growers growing as only crop.	No. of growers growing as part crop.	Total.
Punjab 8A	36	13	49
Karachi	8	—	8
Mentana...	9	4	13
Gluyas	3	7	10
Klein Koren	4	4	8
B.256	—	1	1
Stirling...	1	—	1
Pusa 4	1	3	4
Pioneer	1	—	1
Reward	1	—	1
Kenya Governor	—	1	1

Punjab 8A is still the most widely grown wheat.

The Southern Rhodesian Wheat Crop 1946.

By P. FULLER, Chemist, The Rhodesia Milling & Manufacturing Co., Ltd., Bulawayo.

MIDLANDS DISTRICT.

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The average figures were:—

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Kernel Weight ...	38.35 grams	37.37 grams	37.00 grams
Moisture	9.01%	11.65%	10.00%
Protein...	10.25%	10.44%	9.73%

Grading. Only one lot of wheat was under grade this year; 91 bags weighing 61½ lbs. due to screening; 0.4%.

Moisture. 199 samples were tested for moisture. All the wheat was dry, with the following distribution:—

			1945.	1944.
6- 7%	20 samples ...	10%	—	—
7- 8%	27 samples ...	13.59%	—	—
8- 9%	30 samples ...	30.15%	2.20%	—
9-10%	49 samples ...	24.62%	5.19%	39.8%
10-11%	33 samples ...	16.58%	23.69%	21.1%
11-12%	10 samples ...	5.02%	33.43%	32.6%
Over 12%	—	—	21.10%	6.5%
Over 13%	—	—	14.50%	—

Protein Content. Protein figures were low again this year. This is a big fault with Rhodesian wheat. For satisfactory bread production high protein contents are needed.

208 samples were tested with the following results:—

			1945.	1944.
Less than 8%...	2 samples		—	5.50%
8- 9%...	25 samples ...	13.6%	1.77%	20.9%
9-10%...	80 samples ...	38.4%	32.88%	40.1%
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11-12%...	22 samples ...	10.6%	18.66%	13.0%
Over 12%	7 samples ...	3.3%	8.00%	1.8%

These figures should be compared with protein figures on samples from the Government Plant Breeding Station.

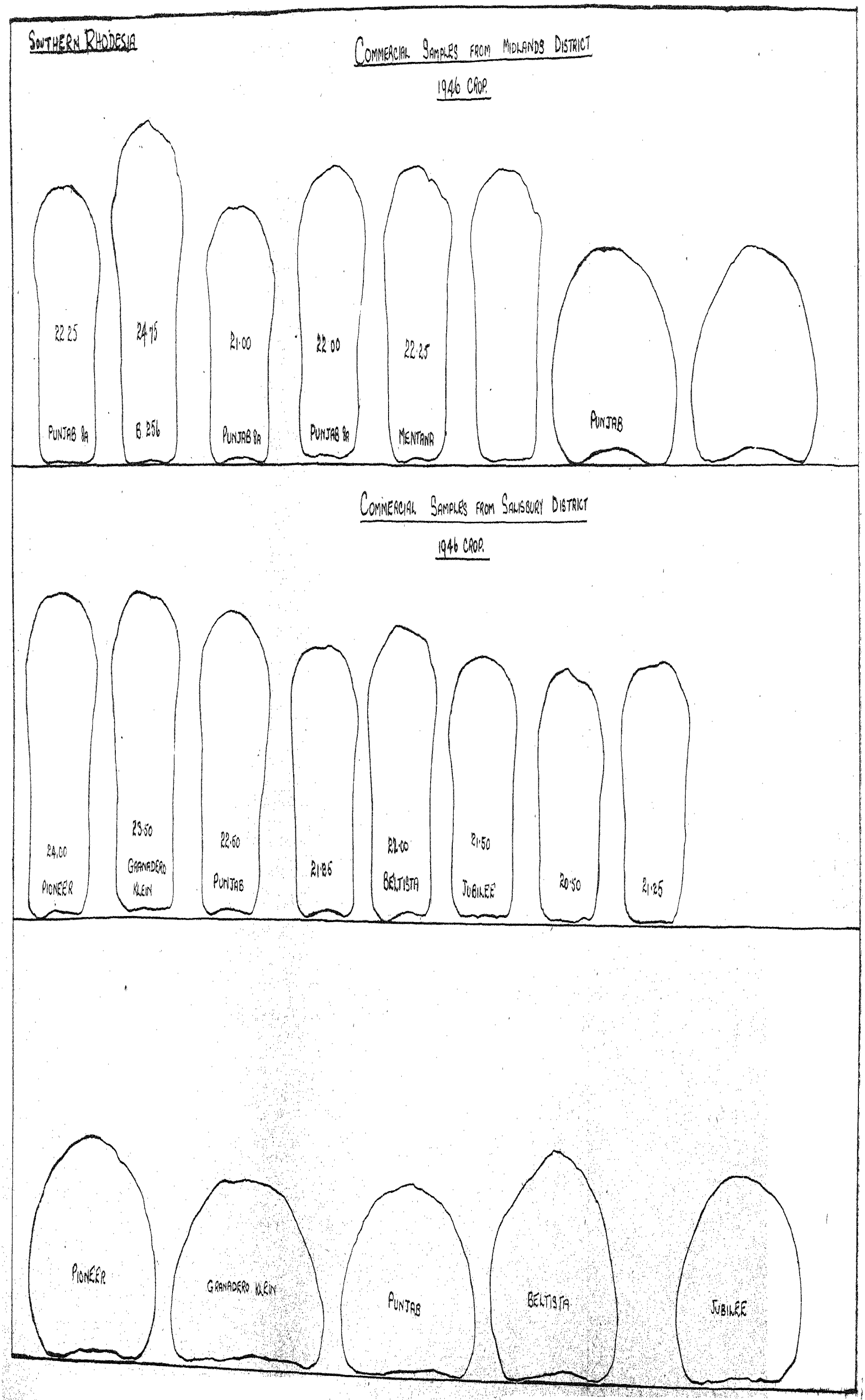
Kernel Weights. 205 samples were counted.

		1945.	1944.
Less than 30 grams	2 samples	—	—
30-35 grams	74 samples 37.07%	23.89%	27.00%
35-40 grams	87 samples 42.44%	52.65%	56.30%
Over 40 grams	42 samples 20.49%	23.45%	17.60%

Varieties Grown. From information received from growers the following varieties were grown this year:—

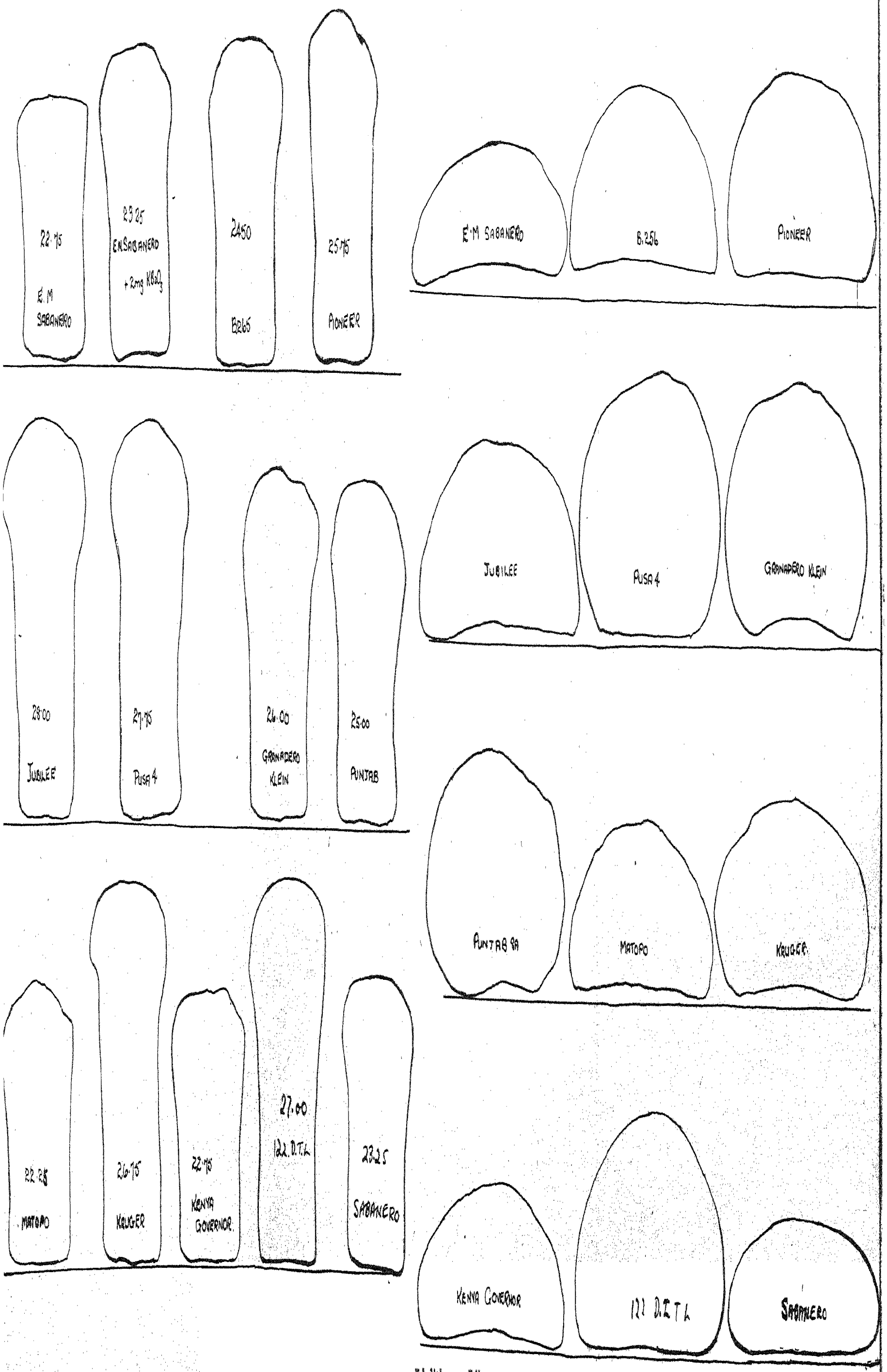
	No. of growers growing as only crop.	No. of growers growing as part crop.	Total.
Punjab 8A	36	13	49
Karachi	8	—	8
Mentana...	9	4	13
Gluyas	3	7	10
Klein Koren	4	4	8
B.256	—	1	1
Stirling...	1	—	1
Pusa 4	1	3	4
Pioneer	1	—	1
Reward	1	—	1
Kenya Governor	—	1	1

Punjab 8A is still the most widely grown wheat.


SOUTHERN RHODESIA
COMMERCIAL SAMPLES FROM MIDLANDS DISTRICT
1946 CROP.
22.25
PUNJAB 8A
24.75
B 256
21.00
PUNJAB 8A
22.00
PUNJAB 8A
22.25
MENTANA
PUNJAB
COMMERCIAL SAMPLES FROM SALISBURY DISTRICT
1946 CROP.
24.00
PIONEER
23.50
GRANADERO KLEIN
22.60
PUNJAB
21.25
22.00
BELTISTA
21.50
JUBILEE
20.50
21.25
PIONEER
GRANADERO KLEIN
PUNJAB
BELTISTA
JUBILEE

SOUTHERN RHODESIA

SAMPLES FROM GOVERNMENT PLANT BREEDING STATION, SALISBURY
1946 CROP.



Average Figures. For varieties.

	Bushel Weight.	Kernel Weight.	%Moisture	%Protein.
Punjab 8A ...	66 lbs.	35.6 gms.	8.9	9.80
Mentana ...	63½lbs.	34.5 gms.	9.1	9.58
Gluyas	62½lbs.	42.5 gms.	10.5	9.71
Karachi	65½lbs.	35.6 gms.	9.9	9.41

Size of Crops. Based on wheat received at Bulawayo Mill.

			1945.
Less than 50 bags	26 growers ...	25.5%	23.85%
50-150	46 growers ...	45.1%	50.46%
150-300	19 growers ...	18.6%	14.60%
300-500	6 growers ...	5.9%	8.25%
Over 500	5 growers ...	4.9%	2.75%

Baking Quality. The baking quality of all the samples tested was *very poor.* The doughs were all lacking in elasticity and stretching power. Oven jump and loaf volume were poor. The poor baking properties are reflected in the National Flour being produced at the present time. When a fairly small proportion of Southern Rhodesian is used there is a drop in the loaf volume and appearance of the bread. The quantity and quality of the protein was not up to the standard required for bread making.

The average loaf measure—22.19 ins.

SALISBURY DISTRICT.

Sixteen samples from the larger growers were tested. Average figures:—

		1945.	1944.
Bushel Weight	65½ lbs.	64¾ lbs.	65½ lbs.
Kernel Weight	40.9 gms.	38.4 gms.	40.0 gms.
Moisture	9.63%	11.95%	11.60%
Protein	9.63%	10.45%	10.38%

Baking quality of these wheats was poor, being similar to the Midlands wheat. The doughs were lacking in elasticity and stretching power. Loaves were small and of poor appearance. The average loaf measure—22.08 ins.

SAMPLES FROM THE GOVERNMENT PLANT BREEDING STATION.

Analytical Figures.

	%Moisture.	%Protein.	Bushel Weight.	Kernel Weight.	Loaf Measure.
Jubilee	8.00	14.65	66½	36.3	28.00 ins.
Pioneer	7.70	14.36	67¼	30.4	25.75 ins.
B.256	9.20	14.25	66	42.4	24.50 ins.
E.M. Sabanero	9.10	13.57	66½	37.3	22.75 ins.
Kruger	9.20	14.82	66½	46.9	26.75 ins.
Sabanero ...	9.40	13.91	65	38.3	23.25 ins.
Kenya Governor	9.60	14.02	63	41.2	22.75 ins.
Matopo	8.40	12.08	67	38.4	22.25 ins.
Pusa 4	9.60	14.71	67½	45.9	27.75 ins.
Punjab 8A ...	7.50	11.68	68	42.9	25.00 ins.
122.D.I.T.L.	8.30	13.11	66	44.6	27.00 ins.
Granadero Klein	9.70	13.57	65	39.5	26.00 ins.

The average figures are:—

Moisture	8.8%
Protein	13.72%
Bushel Weight	66½ lbs.
Kernel Weight	40.3 gms.
Loaf Measure	25.23 ins.

The protein figures are very good. These high figures should be compared with the commercial samples. It will be noticed that Punjab 8A is lower than all the other wheats.

BAKING TESTS.

Jubilee. This wheat produced an excellent dough. It was strong and very elastic. The oven jump was very good. The loaf produced was large and well built. An excellent wheat.

Pusa 4. This wheat produced a very pleasing dough. It was strong and elastic. Oven jump was good and the loaf had large volume. An excellent sample.

Kruger A very good dough. It was strong, lively and had good elasticity. Oven jump was good. Loaf had good volume. A very good sample.

The three samples Jubilee, Pusa 4 and Kruger were very pleasing baking wheats, with good strength and elasticity, producing loaves much above the average for Rhodesian wheats.

Pioneer. This sample produced a satisfactory dough. It had nice strength and stretching power. Oven jump was rather less than the above sample but was quite satisfactory.

Granadero Klein. This dough was very similar to Pioneer. It was quite satisfactory. It produced a very satisfactory loaf. Satisfactory samples.

Punjab 8A. This sample was much better than previous samples examined. The dough had medium elasticity and stretch. Oven jump was medium. Loaf had satisfactory volume. Better than usual for Punjab. Much above the commercial samples of Punjab.

B.256. This sample produced a medium dough. Elasticity was very fair and oven jump was medium. A medium sample.

Matopo. This sample of Matopo was better than samples from previous years but was a long way below the standard of other wheats of this series. The dough was lacking in elasticity and oven jump was only fair. A very fair baking wheat.

Early Maturing Sabanero. A weak sample. The dough was soft and lacked strength. The loaf collapsed in the oven. This dough was treated with 2 milligrams of potassium bromate. There was considerable improvement in the loaf. There was no collapse and oven jump was much improved. The loaf had better volume and was well built. E.M. Sabanero is a weak wheat but will blend with the more stable varieties, and it responds to treatment.

Kenya Governor. This was only a medium dough. Strength and elasticity were fair. Loaf produced was small and not equal to the better samples of this series. A poor baking wheat.

122 D.I.T.L. A good dough, strong and elastic. Oven jump was good. Volume was very pleasing. A good sample.

Sabanero. This sample gave a soft weak dough, which flowed out on the tin. The loaf collapsed in the oven. A poor baking wheat. This sample was treated with 2.5 milligrams of potassium bromate. The response was good. The dough was considerably tougher, oven jump was much improved and the loaf was well built. Loaf measure was 25.00 ins. against 23.25 ins. for the untreated sample.

Summary. All the samples from the Plant Breeding Station were better than corresponding samples tested for the last three years. This year's wheats were very good. Protein quality and quantity were very pleasing. Jubilee, Pusa 4 and Kruger stand out as exceptionally good wheats. Pioneer, Granadero Klein, 122 D.I.T.L. follow on close behind. B.256 and Punjab 8A were medium. Kenya Governor, Matopo and Sabanero were not satisfactory baking wheats. Sabanero is very weak, but it does respond to treatment.

Land Values in Relation to Soil Conservation.

By E. C. WEITZELL.

(Reprinted from "Soil Conservation," February, 1947.)

It is generally recognised that the "land boom" following World War I played an important role in the neglect and exploitation of soil resources during subsequent years. Lower prices for farm products found farmers with excessive debt burdens, which had to be paid from only a fraction of the income necessary to justify 1919 values. The resulting financial distress and widespread mortgage foreclosures are well known. In the effort to retain farms and homes, farmers who saddled themselves with inflated mortgages had no alternative to the exploitation of soil resources. The long-time neglect of resource conservation as a result of the "deplete and move on" philosophy was extended and enforced by the preference of immediate consumption. It is scarcely necessary to remind anyone of the condition of soil resources by 1933.

Non-farmers who purchased farm lands were no more fortunate. Lower incomes encouraged them to "squeeze" tenants and croppers, and to provide a bare minimum of operating capital. As a result, soil resources generally were neglected.

This situation added to the wide neglect of soil resources, and gave rise to the need for subsidies and technical guidance. Too often people forget that society has a stake in any situation which affects the future sources of food, fibre and raw materials. The individual farmer and his family do not stand alone in this respect. Thus, it is important for everyone to realise the need during the next few years to guard against a recurrence of land inflation with its consequent neglect of soil conservation.

Land values are again on the way toward the 1919-20 peak (see Table 1), as seen in the 83 per cent. increase over the 1935-39 average. Whether values generally will reach the World War I peak is still undetermined. But it is worth noting that current farm real estate values in the East South Central and Pacific States are already considerably above the 1920 high. It is true that considerable caution is being exhibited in the North Central States, but even in these areas a gradual advance in land transfer prices is in process. The South-Eastern States include some of our most severe conservation problems, yet this region is now experiencing the greatest increase in land values.

Most authorities are warning against the continuation of soil erosion and depletion that has occurred during the last 5 war years. Even though incomes have been high, the scarcity of labour, machinery and fertilisers has deterred the maintenance of desirable levels of fertility and has slowed the progress of establishing soil conservation measures. The question is: Will this continue? If resources are not protected, and "repaired," during this period of high incomes, the pressures against conservation may be a distinct

handicap at lower levels than currently prevail. High land capitalisation will greatly intensify this problem.

It should be recognised that recent high incomes may not be net, but may consist partially of liquidated capital assets. To the extent that this is true, a part of current incomes should be earmarked as a reserve fund for establishing conservation systems of land management and for replacing depleted resources just as soon as technical help, essential fertilisers, and other soil amendments are available. The repair of buildings and the replacement of machinery are essential complementary resources that should be kept in good condition. Farmers sometimes neglect the maintenance of presently owned resources in favour of more land just as soon as they have a little capital available. In many instances they might be better off by maintaining a smaller acreage at a reasonably high level of productivity and repair, rather than by burdening themselves with mortgage debt and a much larger job of conservation. This is true particularly when the outlook is for substantially lower prices than those which give rise to the inflated "values" now paid for land.

According to available information, net farm incomes (parity ratio) were higher than ever before. The November parity ratio of 124 is 40 points above the 1935-39 average. This is a strong stimulus to higher farm values, and it could be the basis for an extremely disastrous farm land boom, unless everyone puts on the brakes. When looking at the November farm price index of 263, Table 1, we need only to glance at the 1932 index of 68 to imagine what this all means. The November 1 land value index of 152, in all probability, already includes a considerable amount of over-capitalisation in terms of long-run conservation values.

Table 1.—Trend in Land Values, Farm Prices, and Farm Costs, United States.

[1910-14 = 100]

Item	1910-14 base	Index, 1919-20 peak	1932-33 bottom	July 1946
Land values *	100	170	73	152
Prices received †	100	211	68	263
Costs paid †	100	202	120	212

* For land values, 1912-14 = 100 see *The Farm Real Estate Situation, 1944-45*. U.S. Dept. of Agriculture, Cir 743, 1945, and *Current Developments in the Farm Real Estate Market*, U.S Department of Agriculture, December, 1946.

† *Agricultural Statistics*, U.S. Department of Agriculture, 1942, pp 647-8, and *Agricultural Prices*, U.S. Department of Agriculture, November, 1946. (The "costs paid" index is for commodities purchased by farmers.)

More than half of all land transfers in recent months have been entirely for cash. To the extent that this is true the burden of debt will not be a conservation problem. However, landlords are prone to crowd production for a certain level of earnings when

incomes are low. They are reluctant to return needed capital for maintaining soil resources. Since 36 per cent. of all buyers of farm land during the last year were reported to be non-farmers, this is an important consideration.

The activity of the farm real estate market is indicated by the fact that approximately 55 farms per 1,000 changed hands during the year ending March 1, 1946, contrasted to 34 per 1,000 in 1941. During this 5-year period, the total amount of farm mortgage debt was reduced from 6,534 million dollars to 5,080 million dollars, or about 22 per cent. This is encouraging. But accompanying this is an increase in the amount of new mortgages held by private lenders in the amount of 95 million dollars. This probably means a reduction in the length of repayment periods, in as much as private lenders usually provide shorter terms than do federally sponsored credit agencies. Together with higher values, short-term mortgages may mean greater pressure on land resources because of the higher annual payments, depending on the amount of the purchase price encumbered by mortgage.

All of these conditions add up to an over-all picture which may not be conducive to soil conservation. Expansion in these negative factors during the next year would produce a serious situation in this respect. This prospect causes one to inquire as to whether it would not be desirable for farmers to intensify their efforts to build and protect resource productivity now, when farm incomes are relatively high. This depends on the real purchasing power of current incomes in terms of present and future costs. It may be observed that the purchasing power of farm prices (received) in relation to prices paid for essential items of conservation is more favourable now than it has been since 1920. To the extent that farmers do not need to employ additional labour and machinery in order to install conservation practices, this current advantage is considerably greater.

How long farm prices will remain at present levels it is not possible to forecast. All that safely may be said is that they will go down, and the time may not be far off. In any event, it is not possible to foresee long-sustained farm incomes high enough to justify current land values. Unless land can be obtained at a price consistent with long-run probable earnings, it is almost sure to be a burdensome investment.

If we take a look at the history of farm prices up to November, 1946, Table 2, the unusually high current prices stand out. In terms of the long-run situation, however, the "possible 1950" prices are more significant. This projection of possible 1950 prices is based on the assumption of full employment, and as such is exceedingly liberal. The disparity between current and possible future prices, in general, is illustrated by the 103-point difference in the all-commodity farm price index. From the standpoint of long-run land values and the possibilities for a reasonable level of soil conservation, it is likely that the estimated 1950 prices are the maximum that can be hoped for.

The farm production picture forming the setting for the present land value situation is the result of wartime demands. Gross agricultural production was advanced 24 per cent. in 1944, from the 1935-39 base years (see U.S.D.A. Miscellaneous Publication No.

595, p. 5). In general, this expansion in output was not achieved by farming more land, but by increasing the yields of land already being farmed. Higher yielding varieties of grain, soil and water conservation, mechanisation, and other technological developments have led to unprecedented production of both crops and livestock.

War-time needs created the temporary demands, and since the termination of hostilities the provision of relief and rehabilitation has absorbed vast quantities of farm products. In addition, the greatest purchasing power that our people have ever known is currently adding to the demand for food, fibre and oil crops. And there is no indication that the limitations of physical production have been reached.

Table 2.—Trend in Farm Commodity Prices in the United States.

Selected commodities	Prices received by farmers * (Dollars)				
	1914	1919	1932	November, 1946	Possible 1950 †
Cotton (lb.)	0.07	0.35	0.06	0.29	0.13
Tobacco (lb.)	0.10	0.31	0.10	0.44	0.34
Wheat (bu.)	0.97	2.16	0.38	1.89	1.10
Corn (bu.)	0.71	1.51	0.32	1.27	0.90
Beef (cwt.)	—	—	4.25	17.60	10.25
Pork (cwt.)	—	—	3.34	22.80	11.25
Milk (cwt.)	—	—	1.27	5.00	3.10
All commodities ‡	101	213	65	263	160

* *Agricultural Statistics*, U.S. Department of Agriculture, 1942; and *Agricultural Prices*, U.S. Department of Agriculture, November, 1946.

† Estimated as post-war "bench-mark," in terms of full employment. See *Peacetime Adjustments in Farming*, U.S. Department of Agriculture, Misc. Pub. 595. 1945.

‡ Index, 1910-14 = 100.

At the same time, the best estimates that can be made give no hope for a continuation of the present demand for farm products. The only hope for retaining a substantial amount of the current demand rests in the possibility for the creation of a virile and favourable world trade. The obstacles to favourable foreign trade are many. Among them are the lack of purchasing power at the disposal of those countries which might be consumers of our domestic surpluses, and the fact that a large number of the products that might be imported would be in direct competition with domestic production. These are only a few of the considerations that must be reckoned with when looking toward the future of land values. The same factors form the basis for the possibilities expressed at the "1950 bench-mark" prices given in Table 2.

A reduction in demand and farm prices is not followed directly by reduced production. Farmers continue to produce, even though

they may neglect conservation to do so. Unless they can cut overhead expenses, they have no acceptable alternative, as long as they can make any return to fixed costs, above their current or variable costs. This illustrates the close relationship between farm prices, including land values, and the possibility for adequate resource conservation. At least to the extent that conservation is dependent on the purchase of maintenance items, farm income is an extremely important factor. Any burden on income reduces the feasibility of providing the essential elements of productivity maintenance.

Many people do not stop to consider fully the implications of inflated land values in terms of future earning and paying ability. For example, let us assume that a farmer buys a farm at a price of 22,000 dollars, on the basis of current farm prices. He makes a down payment of 2,000 dollars and gives a mortgage for the remaining 20,000 dollars, which is contracted to be paid in 20 equal annual instalments, at 4 per cent. interest. Thus, the total cost of the mortgage (capital and interest) is 29,432 dollars, or a little more than 1,471 dollars per annual payment. It may be supposed, further, that this is the maximum annual payment that could be made in view of other obligations, including soil conservation.

It has already been noted that the most favourable expectations lead to the conclusion that farm prices may fall at least 35 per cent. Considering the fact that farm costs never fall to the extent that prices received do, this price reduction would normally mean a much greater reduction in net income. But for purposes of illustration it may be assured that costs are reduced proportionately, and that net income is decreased 35 per cent.

Then, instead of a value of 22,000 dollars, the reduced net income capitalised at 4 per cent. is 14,300 dollars. Moreover, the farmer's ability to pay has been reduced 35 per cent.; and the new level of income will justify annual amortisation payments of only 1,006 dollars, instead of the annual payments of 1,471 dollars that were previously contracted.

What does the farmer do now ? There are several alternatives: He may reduce his level of living, cancel life insurance policies, default on non-farm financial obligations, exploit the land in an effort to keep his home, or he may default on the mortgage payments and lose his farm and home. The usual tendency, under circumstances of this character, is to neglect the conservation of land resources, first of all, in an effort to hold on. However, this often proves to be the wrong approach, because as resources are depleted, the ability to pay continually decreases. Before long the resources from which a part of the debt might have been paid are reduced to a very low state of productivity. The remedy is to guard against contracting long-term investments on the basis of temporary high incomes.

Conservation farm planners, district conservationists, and district supervisors can do much to prevent the disasters which are sure to follow excessive farm debt. They can teach farmers and other farm-land investors the fundamental facts concerning land values. Warnings against capitalising current high incomes into long-term contractual debt may produce more soil conservation than some of the more direct measures commonly followed.

The Sunn Hemp Beetles.

By E. C. G. PINHEY, B.Sc., Entomologist.

In recent years many growers of sunn hemp in this Colony, particularly in the districts of Salisbury, Mazoe, Lomagundi, Hartley and Marandellas, have suffered annually from the depredations of the sunn hemp beetles on this crop. The earliest record of these beetles in the Department of Agriculture was in 1911, when they were found on a wild *Senecio*, but the first report of damage to sunn hemp was from Salisbury, in December, 1926. Since that year beetles have increased in numbers in some areas where sunn hemp is grown, by breeding in successive crops of sunn hemp, until in the 1944-45 season it was calculated that the infestation at Salisbury Experimental Station had reached a population of over 3½ millions of these beetles per acre of infested land. An apparently harmless insect thus became a major pest through the activities of man.

Nature of Damage. The adult sunn hemp beetles feed from November to January on the leaves of sunn hemp (*Crotalaria juncea*, L.) and other plants of the genus *Crotalaria*, some of which have been tried out experimentally for comparison with sunn hemp. Sunn hemp which has recently been planted may be attacked by the beetles in the seedling stage. The surface of the cotyledons is pitted by their feeding, and when they are in large numbers entire fields may be destroyed. The beetles do not as a rule directly damage the plumule, so that the seedlings which can survive the initial attack may live, but produce a poor stand. Well established plants can withstand the damage unless the beetles are very numerous, but a promising stand of sunn hemp which appears to have withstood attack by the beetle early in the season may suffer later from attack by the larvae of these beetles, which feed on sunn hemp roots and damage the bacterial nodules, thus affecting both the health of the plants and the fertility value of the crops.

Uses of Sunn Hemp and the Possibilities of Substitute Crops. Sunn hemp is grown in this Colony chiefly as a weed-suppressing green manure crop and, to a lesser extent, for hay, compost, as a cover crop in orchards, or for seed. In India it is an important source of fibre. For green manuring, sunn hemp is ploughed under at any convenient time after it has fully matured, but to benefit by the bonus for maize grown in accordance with sound farming practices, it must be ploughed in before May 31st. Flowering commences nearly three months after the cotyledons appear above ground, so that if the crop is sown soon after the start of the early rains, the crop would be ready for ploughing in in early March. The best time to plough in is from mid-March to the end of April, although some farmers leave the crop standing for a longer period. Sunn hemp grown for hay is cut before maturing and after about 2 to 2½ months' growth, when it is still fresh and growing and not

too fibrous. When grown for seed, it is left standing after the pods are fully formed until a convenient time for cutting and threshing. The principal variety of sunn hemp grown in the Colony is the "Somerset" strain. The advantages of sunn hemp, in comparison to other green manure and hay crops, are as follows:—

(1) Sunn hemp will grow readily in a wide range of soils.

(2) It withstands drought well.

(3) By rapid and dense growth it smothers weeds.

(4) The roots develop abundant root nodules.

(5) It is easy to plough under as a green manure crop.

(6) For seed purposes it retains seed in the pod very satisfactorily.

(7) Its fibre, in countries where it is grown for this purpose, is of high value.

(8) Compared to many other legumes and to sunflower, sunn hemp is highly resistant to root knot eelworm.

Owing to the reduction in seed yield of sunn hemp caused by beetles, as well as other insects and a fungus disease, various crops, such as velvet beans, Dolichos beans, cowpea and sunflower, have been suggested as substitutes. The yield of maize following velvet beans, Dolichos beans and cowpea has proved equal to that following sunn hemp in a number of trials. But from the point of view of farm practice, none of these compares with sunn hemp. In particular, they are not so effective in smothering weeds, and cultivation is necessary; they are planted late; they are more trouble to plough under and they do not retain their seed in pod so long. Although velvet bean is singularly free from insect attack, cowpea and Dolichos are subject to many pests, including eelworm, stem maggot, stem weevil and cowpea beetle, a relative of sunn hemp beetle but not known to attack sunn hemp itself. Velvet beans, owing to their recumbent growth, are especially difficult to plough in. Sunflower, as it is not a legume, does not furnish the soil with as much nitrogen. It is efficient in smothering weeds, but may produce considerable re-growth if not ploughed under soon enough, owing to its heavy "seed" yield, and as a consequence it may smother a subsequent crop. It is highly susceptible to eelworm. An important value of sunflower as a substitute is its low cost.

Sound farm practice requires the use of one of these crops for green manuring, and at present sunn hemp is the most satisfactory for the purpose.

Habits of Sunn Hemp Beetles. Sunn hemp beetles emerge from previously infested lands soon after heavy falls of early rains commencing in November. Early on sunny mornings following a rainfall of ½ to 1 inch or more in the previous 48 hours, they may be observed leaving the soil through small exit holes. They may then fly to any sunn hemp which may be growing on or near the area where they emerge and will settle on the plants and feed on the leaves. If no sunn hemp is nearby, they may rest on any available plants, such as sweet potato, maize or other crops, or on weeds, sticks or fencing. In sunshine they show a marked tendency to

migrate soon after leaving the soil, usually travelling with the wind. On dull or wet days they seek shelter under leaves of plants or in any other convenient place. The beetles feed chiefly in the morning on fine days, but on days when there is only intermittent sunshine they may feed at any time of the day. In cloudy or wet weather they are rather inactive. Although the beetles start emerging after the early rains, a few adults may be found as late as the second week in January. They can live for nearly two months after emerging from the soil if food is available. But immediately they have emerged they have sufficient internal food reserve to last two or three weeks without feeding.

Foodplants. The only general crop which these beetles will readily attack is sunn hemp, *Crotalaria juncea*, L. On the veld they feed on indigenous species of *Crotalaria*, and they have also been found eating the leaves of a related plant, *Eriosema* sp. There have been several reports of them on other wild plants, such as *Senecio* and *Indigofera*, and on crops such as maize and various species of beans, cotton, *Sesbania* and Tung Oil. In confinement, however, although they readily feed on sunn hemp and other *Crotalaria*, it has not been found possible to induce them to feed on any plants but *Crotalaria* and *Eriosema*, except, among many beans tried, minor damage was done to haricot beans when in the seedling stage only. In the case of the plants, other than *Crotalaria* and *Eriosema*, on which they have been reported, these beetles were probably either resting or else they may have been other species of beetles, often confused with the sunn hemp beetles, such as the cowpea beetle and the Sesbania beetle. In some cases where, for instance, true sunn hemp beetles have been found on damaged maize plants, it is probable that the leaves had been eaten by some other insect, such as one of the Snout beetles. It may be noted that when their own food plant is not available, sunn hemp beetles have been known to feed on over-ripe fruit in an orchard.

Descriptions of Sunn Hemp Beetles and Their Life Cycle. Sunn hemp beetles belong to the genus *Exora* of the family *Galerucidae* (*Chrysomelidae*, part). The species concerned are *Exora discoidalis*, Jac., *E. apicipenne*, Jac., and *E. kohlschütteri*, Wse.

Adults. The beetles are elliptical in shape, about 6 or 7 mm. long and 2 or 3 mm. broad. They are mainly dark brown or black, but the elytra or wing cases are marked with orange or yellowish-brown. In *E. discoidalis* the elytra are black with an orange patch at each end; in *E. apicipenne* they are entirely black except for yellowish or orange at the outer (posterior) end; in *E. kohlschüteri* the elytra are yellowish-brown with the orange tip as in *E. apicipenne*. On the underside the males are entirely black, but the abdomen of the female may be black or orange. Intermediate colorations of the elytra are very common. The males can be distinguished from the females by the presence in the former of a minute depression, just visible to the naked eye, on the underside of the hind end of the abdomen.

There is only one brood in the year. After emerging from the soil in November or December, the beetle feeds, as mentioned above, on the foliage of *Crotalaria*. After pairing, the females

lay their eggs singly in moist soil near the food plant at a depth of up to 2 inches.

Eggs. The egg is cemented to a soil particle. It is oval, about ¾ mm. long and ½ mm. broad; white, cream-coloured or pale yellow in colour, and, when seen under a strong lens, it has a reticulated surface. The length of time elapsing before the egg hatches has not been fully worked out, but it is about two weeks after laying.

Grubs. The grubs or larvae which hatch from the eggs are elongate and white. They develop a stout shield with a horse-shoe shaped ridge on the terminal segment of the body. When touched, they can emit a sticky fluid from the sides of the body. The larvae feed on the roots of sunn hemp from January to March, undergoing 4 moults. If the plants have developed bacterial nodules, they feed and bore into these. Otherwise they feed on lateral rootlets or score and partially tunnel into the tap root. If infested sunn hemp is ploughed under and replaced by a different crop, it is probable that the larvae will transfer their attentions to the roots of the subsequent plants.

Resting States. About the end of March or in April the larvae cease feeding. Each individual forms a small earthen case in the soil at a depth of 6-12 inches. The body becomes bent or hooked at first, later becoming contracted, and in this condition the larvae hibernate through most of the dry season. As the weather becomes warmer, they metamorphose and become pupae. The pupa is stout, elliptical and white, with legs and wings of the future adult free and easily discernible. Within about three weeks or a month they metamorphose again, this time into adults, which, however, remain in the earthen cases, awaiting sufficient heavy rain to produce the soil moisture required to induce them to emerge from the ground. These resting adults have been found towards the end of October.

Only a few natural enemies are known to attack sunn hemp beetles, and these are of little importance in controlling them. They include insectivorous birds, thread worms, parasitic wasps and fungus disease.

Some Beetles with which Sunn Hemp Beetles are Frequently Confused. There are two close relatives of sunn hemp beetles with which they are commonly confused, but for the layman it is not easy to distinguish sunn hemp beetles from many other species. These two relatives are the Cowpea beetle, *Ootheca mutabilis*, and the Sesbania beetle, *Mesoplatys ochroptera*. In the cowpea beetle, unlike the sunn hemp beetles, the elytra are either entirely orange (male) or entirely dark blue (female), without any distinct orange or yellow patch at either end. The head and thorax, as well as the underside of the whole body and part of the legs, are orange in both sexes. This beetle feeds on many kinds of beans and peas, especially cowpea, soya, Dolichos, jack bean and also on cotton. Its adult appears later in the season than the sunn hemp beetles. The larvae of the cowpea beetle feed on the roots of the plants in a similar way, but, with the aid of a strong hand lens, they can be distinguished by having a hard plate just behind the head, and the horse-shoe shaped ridge on the shield of the last segment is replaced by a few straight ridges.

The Sesbania beetle, which has so far only been found to feed on Sesbania, is a broader beetle, with plain brown elytra, black head, thorax and legs. The larvae are entirely different from those of sunn hemp beetles, for they are jet black, active and feed amongst the adults on the foliage, not on the roots, of the plants.

Control Measures. Of the various methods tried in controlling sunn hemp beetles, only the following measures can be considered effective. These can be divided into *chemical measures* and *cultural methods.*

One of the principle things to bear in mind in considering the control of these beetles is that they have only one brood in the year. From a study of their life cycle it may be seen that direct control of the adult has to be effected at the beginning of the rains, while at other times of the year, any measures carried out concern the larvae or pupae in the soil. Biological control by natural enemies is not considered practicable.

Chemical measures have the disadvantage of expense, especially when large acreages are infested with the beetles. Arsenate of lead spray has been found effective in killing the adults on small areas and D.D.T. preparations have proved effective under laboratory conditions. It may be mentioned that it has been found experimentally at Trelawney Tobacco Research Station that 5% D.D.T. dust or 0.5% Gammexane dust, using either material at the rate of 20 lbs. per acre, resulted in 98% control of sunn hemp beetles. It has not yet been decided what is the lowest percentage of D.D.T. required to kill the beetles and it is probable that a D.D.T. spray might be employed effectively at a lower concentration than the 5% used as dust. The cost of 20 lbs. of D.D.T. dust is now about 10/- to 15/-.

At present the only recommendation for spraying that can be suggested is in instances where a trap crop is put down to attract the beetles emerging with the first heavy rains. Such a trap crop of sunn hemp could be planted in close stands or as a strip about 1 or 2 yards wide around the boundaries (headlands) of sunn hemp lands infested in the previous season as early as possible in November. When heavily infested with the beetles the trap crop must be thoroughly sprayed with arsenate of lead at the rate of 1 lb. powder to 40 gallons of water, with the addition of some spreader. About 30 to 50 gallons of this spray, using a knapsack sprayer, would be sufficient for an acre of plants 6 to 12 inches high. This would amount to about 1 lb. of arsenate of lead which, with the addition of a little spreader, would cost at present prices about 2/- to 3/- per acre. It would be necessary to repeat the application after heavy rain. It is not advisable to grow trap crops of any kind unless the pests they attract are destroyed by spraying or by other measures, otherwise the infestation of the succeeding main crop might be more severe than if no trap crop had been planted.

Regarding the early stages of the beetle in the soil, one of the new soil insecticides might prove effective in their control, but this has not yet been established. They would probably have to be applied when the land is clear of any crop and would be

aimed at the prevention of the emergence of the adults of the succeeding generation.

Cultural methods are far more important than chemical measures in the control of pests of a green manure crop such as sunn hemp, as they are normally more economical and may be more adaptable to farm practice. Such methods which can assist in reducing the numbers of sunn hemp beetles may be considered under the following headings:—

(a) delayed sowing of sunn hemp to evade attack by the adult beetles;

(b) inclusion of widest practicable separation of sunn hemp lands on the farm to evade or reduce attack by the adult beetles;

(c) omission of sunn hemp from the planting programme on a community basis for 2 or 3 years to decrease the local population of the pest; and

(d) additional cultivation of infested lands to destroy the larvae or pupae in the soil.

(a) In recent years many farmers have avoided damage to sunn hemp by delaying their planting until about the third week in December as recommended by the Entomological Department. The beetles emerge in batches from the soil after each heavy fall of early rain. If the rains are late, however, it is advisable to delay planting until well after two or three drenching rains in December, each of over one inch, within two or three days, which may delay planting until the first week in January. Delayed planting interferes with routine farm practice. It involves suppression of weeds at a time when labour is urgently needed elsewhere; the damp soil after a succession of heavy rains is difficult to sow, and there is the danger of heavy soils packing if wet when they are cultivated to kill weeds; and in extreme cases the crop may have to be ploughed under before it is sufficiently mature and this would appreciably reduce the yield of the following maize crop. Nevertheless, many good farmers apply this method successfully. Where delayed planting is possible, this measure can be combined with trap cropping on the previous season's sunn hemp lands as long as the trap crop, when infested, is thoroughly sprayed or the beetles destroyed in some other way, as stated above.

(b) and (c). Since the sunn hemp beetle practically confines its attacks to sunn hemp, the normal practice of rotation cropping assists in keeping down the number of beetles in individual lands; and where the sunn hemp lands are widely separated from year to year the infestation is likely to be on a reduced scale. If, however, a substitute crop can be grown for two or three years, there should be a marked reduction in the number of beetles. For this measure to be really effective, however, it is suggested that all sunn hemp growers within a certain region should omit sunn hemp and other *Crotalaria* from their planting schedules, over a period of at least two years. If this measure could be adopted by farmers in areas known to suffer from sunn hemp beetles and

strictly carried out on all farms in those areas, it is almost certain that this beetle would not be a menace to sunn hemp for some time, possibly several years. It might be advisable, however, to repeat the measure over, perhaps, one season, leaving out sunn hemp as a crop every third or fourth year after the original two-year period, to prevent the beetles multiplying again as they have done in recent years.

Community control by omitting sunn hemp from planting schedules may appear inconvenient. But from an economic point of view it appears the most reasonable method of effecting control of the beetle at present, other than replacing sunn hemp altogether as a green manure crop by the most suitable substitute other than *Crotalaria* that can be found. Any substitutes so far tried have individual disadvantages and apart from damage by pest and disease, and the difficulty of obtaining seed, sunn hemp is still considered superior as a green manure crop. Some of these substitutes are mentioned above.

(d) It has been found that deep ploughing of infested lands reduces the number of adults emerging later, evidently destroying many of the larvae or pupae in the soil. Experimentally it has been shown that ploughing in different months can show differing results in reduction of emerging beetles, but more than one ploughing may be necessary to effect an appreciable control and the ploughing must be deep, that is to say, down to at least 8 or 9 inches where the depth of surface soil will allow this. As a green manure crop, sunn hemp is ploughed under usually in March or April, when it is fairly mature. When ploughed under late it does not decay for many months and it is impracticable to replough the same land unless it could be cross-ploughed with a heavy disc plough with sharp discs. Alternatively, it might be disc harrowed in October; this would not have as much effect on the grubs and pupae as ploughing, but combined with the earlier ploughing in of the crop it should effect a marked reduction in the numbers of beetles. On the other hand, where the crop is cut for hay, or, later, for compost, the stubble could be ploughed under at any convenient time, say April, and a further ploughing might be carried out on the same land, followed by harrowing, in October or during the first week of November. Where the second ploughing can be performed it would have the added advantage of improving the tilth of the soil.

SUMMARY OF CONTROL MEASURES.

1. The most effective method of controlling sunn hemp beetles would be for all sunn hemp growers in areas known to be infected with sunn hemp beetles to avoid the use of this crop for the same two or three years, by utilising a substitute crop during that period. After that it might prove to be necessary to continue to omit sunn hemp periodically, perhaps every fourth year, from their planting schedules.

2. Of the other methods, late planting of the sunn hemp crop has been shown to be practicable and successful in many cases. The seed should be sown as late as possible after the middle of December, even in early January if this can be managed.

3. An early trap crop of sunn hemp can be planted around lands which had an infested sunn hemp crop in the previous season to occupy the attention of emerging beetles, provided that these are destroyed when the trap crops have become infested.

4. Ploughing in the crop in March or April effects a reduction in the numbers of beetles, but control is more effective if the land is re-ploughed, or at least, disc harrowed, in the following October.

REFERENCE.

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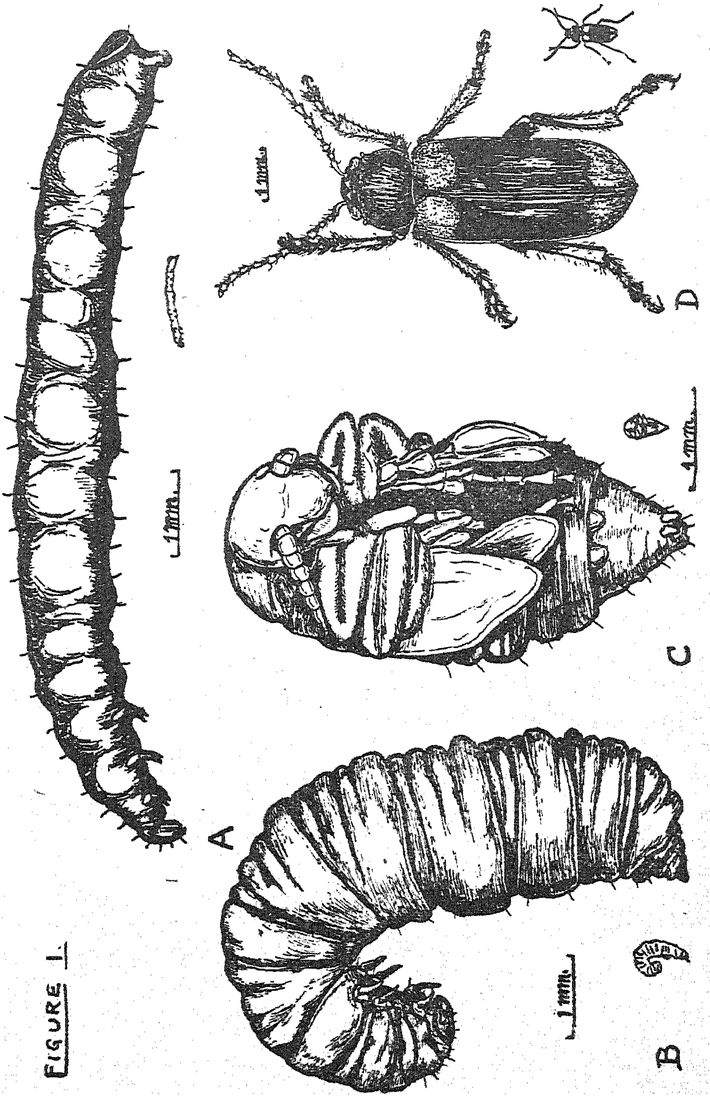


Figure 1. Sunn Hemp Beetles.—A. Full-grown larva. B. Hibernating larva. C. Pupa. D. Adult. *Exora discoidalis*, Jac. The figures are enlarged: natural size inset.

Reinforced Brick Grain Bins.

(Contributed by the Grain Bag Shortage Committee.)

The Committee appointed by the Minister of Agriculture to investigate alternative methods of storing grain on the farm to help relieve the present shortage of grain bags has come to conclusions which are set forth in the following article.

The Committee believes that while purely temporary structures of a makeshift nature might have been suggested, the great majority of farmers will prefer to construct something more reliable and permanent. Quite apart from the present shortage, the customary method of storing grain in bags is very wasteful both of bags and grain, and storage in properly constructed bins is much to be preferred. The choice of suitable materials for the construction of such bins is very severely restricted at the present time by the prevailing shortage of cement and all forms of steel, but the Committee believes that the design of bin described and illustrated in this article, although requiring the minimum quantity of such materials, will prove a satisfactory and reasonably permanent asset.

Investigations were carried out on a number of other designs using various materials, but none of these was considered to be as suitable for general adoption as the design now recommended.

Demonstration Bin. A demonstration bin has been built in accordance with this recommended design and may be seen at the back of the Creamery of the Farmers' Co-op., Ltd., Wynne Street, Salisbury. Various details have been left incomplete or uncovered, so that the method of construction can easily be seen. The Committee has also erected on the same site, an experimental bin of curved corrugated asbestos sheets on a brick base. The object of this experiment was an attempt to eliminate the use of wire and to reduce the number of bricks and the amount of cement required in the construction of the brick bin.

The use of this material cannot, however, be recommended by the Committee for such a purpose, except, perhaps, in very exceptional circumstances, as considerable skill and judgment is required in its erection, and a very large number of bolts are necessary to give the joints the requisite strength. Further, the fitting of an effective and economical ceiling over the bin presents considerable difficulty. Anyone interested in this type of construction is therefore advised to consult the Agricultural Engineer, Irrigation Department, for more detailed information.

It must be stated that the manufacturers of the asbestos sheets did not recommend or favour the use of this material for this particular purpose, although under preliminary tests it proved far stronger than was anticipated.

General Recommendations. The Committee recommends that bins should be circular rather than rectangular. The former can be built with adequate strength with the minimum amount of material, whereas rectangular bins require the use of an extravagant amount of brickwork.

The Committee considers that the capacity of grain bins of this type should be limited to 250 bags, and believes that the majority of farmers who require considerable storage will find it more satisfactory to build a number of bins of this capacity rather than one or more larger bins.

The Committee strongly recommends that wherever possible bins should be built under cover of an independent building or roof in order that the bin shall not be subject to rapid and considerable changes of temperature. The theory underlying this recommendation, which has been confirmed in practice, is, briefly, that in a bin exposed to the hot sun during the day the air will become partially saturated with water vapour which, on a cold night, will condense into liquid water on any cool surface with which it comes in contact. This water may accumulate at the bottom of the bin and cause the grain to become mouldy. It follows, therefore, that if a bin cannot be entirely enclosed within an outer building, it should at least be protected from the sun as much as possible by an overhanging roof of thatch or other more durable materials. The great advantage of providing such a roof is that it is then only necessary to close the top of the bin with an inner roof or ceiling to make it vermin-proof and reasonably air-tight. It will be seen from the accompanying drawing that such an inner roof can be easily constructed.

Reverting to the matter of condensation of moisture within the bin, it is pointed out that the inner surface of the wall should not be plastered, since the plaster presents a cool, rather impervious surface on which moisture may condense, whereas an unplastered brick surface will absorb quite an appreciable amount of moisture without becoming sufficiently damp to injure the grain. Again, both the timber ceiling and the asphalt floor will be less likely to condense water vapour than concrete will.

The Design. The design of bin recommended is shown in Fig. 1 in the accompanying drawing. It will be noted that the circular reinforced wall may be built either 9 in. thick or, alternatively, $4\frac{1}{2}$ in. thick, as shown in Fig 1a.

A 9 in. wall is generally recommended as giving a more substantial job, particularly for bins which are to be erected in the open, since it affords far better support for the ceiling and outer roof. When the roof is to be an independent structure, a $4\frac{1}{2}$ in. wall should prove quite satisfactory, but a little more care will be required in sealing the edges of the timber ceiling.

A $4\frac{1}{2}$ in. wall requires more careful workmanship. The bricks must be sound and of good shape, and 1-5 cement mortar must be used for laying them.

Dimensions and Capacity. A bin 12 ft. 6 in. internal diameter by 10 ft. high will hold approximately 250 bags, that is, 25 bags for

each foot of height, and one of 10 ft. internal diameter by 10 ft. high will hold 150 bags, or 15 bags per foot of height.

These dimensions may be varied to suit individual require ments, but if the height or the maximum diameter of 12 ft. 6 in. is exceeded, additional reinforcing wire may be required and technical advice on the matter, which may be obtained from the Irrigation Department, should be sought.

The Outlet Pipe. A suitable design of outlet pipe and shutter is shown in Fig. 4. This is made from 18 or 16 gauge sheet iron, and provision is made for securing the shutter with a padlock as a safeguard against theft. Ordinary 5 in. or 6 in. water pipe fitted with a similar type of shutter or a screw cap can be used if preferred. If necessary, the shutter can be sealed up with bitumen putty to exclude air and insects.

Building the Foundation and Wall. Some reliable means of keeping the foundation and wall of the bin truly circular and vertical is essential, and Fig. 2 shows two alternative methods of doing this.

A straight length of pipe, 1½ in. or larger or a smooth, straight pole should be set up at the centre of the site and stayed with three or more wires to maintain it in a perfectly vertical position. A piece of thin wire can then be attached to the pipe so that it is free to turn in any direction. This wire can be marked or kinked at the different radii required for setting out the foundation trenches and subsequently guiding the brickwork. It will be necessary to support the wire by an adjustable clamp attached to the pipe so that it can be kept level with each course of brickwork. It will also be necessary to keep a constant check on the level of each course of brickwork as it is laid. If care is taken to see that the top of the 14 in. foundation is quite level, the height of each course of the 9 in. wall can be readily checked therefrom by means of a course stick, i.e., a light lath of wood which can be held vertically on the projecting edge of the foundation, and against which the height of the wall can be measured from time to time. The repeated use of the spirit level is then unnecessary. Alternatively, a sweep consisting of a light triangular wooden frame constructed as shown on the right of the diagram will be found a very convenient means of keeping the brickwork not only circular and vertical but level also. The frame is supported by an adjustable clamp attached to the centre pipe about which it rotates. The vertical plank at the extremity of the frame against which the bricks are laid must be perfectly vertical when the sweep is turned in any position.

The foundation trench must extend down to a hard, compact formation and should be not less than 12 in. deep. The bottom of the trench should be level and should be tamped all over to consolidate the sub-soil.

The foundation ring should consist of two courses of 18 in. brickwork followed by 14 in. work until it reaches the required

height of 1 ft. 9 in. above the surrounding ground level. A foundation of this height will not require reinforcing, but if carried appreciably higher it should be reinforced.

The mortar used for laying the bricks both in the foundation and wall may be either 1-5 cement mortar or, alternatively, a strong lime mortar with an admixture of 10 per cent. of cement. The lime mortar should be mixed in the proportion of 1-5, that is, $1\frac{1}{4}$ bags of lime to one cubic yard of sand. The lime must be thoroughly slaked for at least two weeks, and longer if possible. The cement should be added to each small batch of mortar as it is prepared for the bricklayer, and each batch should be used up within three-quarters of an hour from the time the cement is added. Whichever mortar is used, the bricks should be dipped in water for a few moments before they are laid.

The outlet pipe should be set at the proper height in relation to the floor, i.e., $1\frac{1}{8}$ in. above the top of the foundation and at an angle of 30 degrees from the horizontal. It should be bedded in 1-5 cement mortar.

The top of the foundation should be levelled off with a $\frac{1}{2}$ in. screed of 1-4 cement mortar trowelled to a smooth even surface.

A good damp course is essential and should be cut to the same width as the foundation. If damp course felt is used it may be cut in segments of the required curvature to fit the wall. The segments may be cut across the width of the roll so that they are 3 ft. long. These are laid with an overlap of 3 in. at their outer edges. Galvanised iron, if available, may be used for the damp course, in which case the joints should be soldered, and only cement mortar and not lime mortar must be allowed to come in contact with it.

The recommended procedure for laying the 9 in. reinforced wall is shown in Fig. 3 and is briefly as follows: Three courses of stretchers forming the inner half of the wall are first laid. These are then encircled with 4 complete turns of wire. The wire used should be $12\frac{1}{2}$ gauge high-strain steel wire, but if this is unobtainable ordinary 8 gauge fencing wire may be substituted. Barbed wire might also be used with safety, but the barbs make it very inconvenient to handle. The wire may be put round in separate rings, but it is preferable to wind it on in a spiral, two turns being made in a downward direction and the other two turns in an upwards direction so that the ends meet. In order to be able to draw the wire fairly tight—it need not be strained—and to avoid the danger of breaking the wire, as might happen if it were tightly hooked or twisted together, the method of joining shown in the diagram is recommended. The two ends of wire are overlapped and bound together with closely wound binding wire—14 or 20 gauge fencing wire is very suitable for this purpose. The binding should be at least 2 in. long. The ends of the steel wire can then be pulled through the binding until the hoop round the bin is tight. The free ends are then bent back over the binding and cut off, leaving a pronounced hook at each end. These joints should be made at different points round the circumference of the bin so that they do not result in a vertical line of weakness in one place.

The three outer courses of stretchers are then laid in the ordinary way, particular care being taken to see that the vertical joint between the inner and outer courses is well flushed up with mortar so that the wire, especially at the joint, is thoroughly embedded. A course of headers is then laid to complete this first section of the wall. The floor should be laid at this juncture, as explained in the next paragraph. When it is finished, the next and subsequent sections of wall can be built in exactly the same way as the first, except that the number of turns of wire in each section should correspond to that shown in the drawing.

Since the bin is not to be plastered internally, the joints should be completely filled with mortar and neatly struck.

The Floor. When the foundation ring is completed, it can be filled in to the required level to receive the floor. The filling material should consist of a sandy or gravel soil which should be placed in uniform layers about 4 in. thick. Each layer must be thoroughly compacted by tamping before the next layer is placed. Particular care should be taken to ensure that the filling of the foundation trench on the inside of the brickwork is thoroughly compacted. The tamping near the wall must be thorough, but not sufficiently violent to disturb the brickwork, which should, if possible, be allowed to set for one or two days before the filling is placed. The actual floor on which the asphalt sealing coat is to be placed may be either of bricks laid flat and grouted with 1-5 cement mortar as for an ordinary brick floor, or, alternatively, it may consist of a well tamped layer of hard core consisting of gravel or broken, hard, well-burnt bricks, three or four inches thick. In order to provide a sufficiently firm, smooth surface to take a coat of bituminous paint, the hard core should be lightly plastered over with 1-5 cement mortar well worked into the surface.

The surface of the brick or hard core floor must be flush with the damp course.

The asphalt sealing coat, which must form an impervious joint between the floor and wall, is most conveniently laid when the wall is four courses high, and since it is desirable that the grouted surface on which it is laid should be as clean as possible, it is advisable to delay the grouting until these first four courses of brickwork have been completed. It must, however, be remembered that the grouted surface and the lowest course of brick walling must be quite dry before the bituminous paint is applied.

The Asphalt Sealing Coat. Although the following instructions for the laying of an asphalt floor may sound somewhat complicated, the job presents very little difficulty in actual practice. The appliances required are as follows:—

(a) A 44-gallon drum, which may for convenience be cut down to half or three-quarters of its original height. This is to be used as a vessel in which to heat the bitumen.

(b) A sheet of iron about 6 ft. x 3 ft. with the edges turned up to a height of about 3 in. to form a tray in which to heat

the sand. A piece of old corrugated iron or the side of a 44-gallon drum roughly flattened out will serve for this purpose.

(c) An ordinary large bucket or a 5- or 10-gallon drum in which to mix the hot bitumen and sand.

(d) A plasterer's steel float and bricklayer's trowel.

(e) A bailer, which may consist of a 2 lb. jam tin fitted with a handle, for bailing and measuring the hot bitumen out of the heating drum into the mixing bucket. Another tin of the same size for measuring the required quantity of hot sand.

(f) An earth rammer, preferably of metal, or of timber with a metal-covered face.

Materials Required. The grade and quality of the materials required are as follows, the quantities necessary are given elsewhere:—

(a) Bituminous paint, ordinary good commercial quality.

(b) *Bitumen. Grade 80/100 penetration.

(c) Sand. Ordinary clean veld sand with particles ranging from fairly coarse grit down to a fine floury dust is recommended.

The presence of a sufficient quantity of very fine material in the form of fine silt or dry powder like clay is required to give the asphalt the necessary density, and if such material is lacking in the natural sand, it may be added thereto in the proportion of about 15 per cent. If some such natural material is not available, ordinary Portland cement is an excellent medium for the purpose.

Sand, silt or clay dust containing an appreciable amount of vegetable matter should not be used.

Preparing and Laying the Asphalt. When the cement-grouted surface of the floor is perfectly dry it should be given a coat of bituminous paint. This coat should extend 3 or 4 in. up the wall and should be well worked into the cement and brickwork to form a key for the asphalt. After an hour or so the paint will be sufficiently dry to receive the asphalt, which is prepared and laid as follows:—

The 44-gallon drum is stood on brick or stone supports to raise it 6 or 7 in. from the ground and the requisite amount of bitumen is placed therein. A slow fire is lighted under the drum to melt the bitumen. The heating must be done very slowly until all the bitumen has melted and become quite fluid. This is the condition in which it is to be used, and only a very small fire will be necessary to keep it hot. The bitumen should be stirred at frequent intervals while it is melting and subsequently to prevent it becoming overheated at any one spot. If it is over-heated it will give off a thick

*Bitumen is supplied in drums holding approximately 33 or 44 gallons and the cost is approximately 2/- per gallon.

white or blue smoke and rapidly become quite useless, since it will then lose its essential plastic properties when cold.

While the bitumen is being heated, the sand must also be heated. For this purpose the sheet-iron tray is also supported on bricks or stones and covered with sand to a depth of 3 or 4 in., while a small fire is lighted underneath it. The sand when used should be decidedly hotter than can be borne by the bare hand, but not so hot that it will tend to over-heat the bitumen when added to it. The actual temperature recommended is 200 degrees F.

It should be turned over occasionally to distribute the heat uniformly, and as it is taken for use from one end of the tray, the remainder should be moved along and a fresh supply added at the opposite end so that a continuous supply of hot sand is available as required. If the sand is damp, it must be heated long enough to drive off all moisture.

When the bitumen and sand are ready, they must be thoroughly mixed together in the proportion of 1 part of bitumen to 5 parts of sand by volume. The following procedure is suggested as a convenient method of doing this:—

A 2 lb. jam tin may be used both for a measure and as a bailer to transfer the bitumen from the drum to the bucket. If a large bucket is used, 3 tinsful of bitumen should be placed therein, to which the sand is added with a second measuring tin of the same size. The sand must be added gradually while the mixture is vigorously stirred and mixed with a strong, flat stick. Mixing is more difficult as the quantity of sand is increased. Fifteen tinsful of sand will be required to give the required proportion of 1 to 5, but if a 5- or 10-gallon drum is used in place of a bucket, the quantities can be increased proportionately and larger measures may be used, but some difficulty may be experienced in mixing the larger quantity satisfactorily.

When the asphalt is thoroughly mixed, it is dumped out on the floor and worked to a smooth, even layer $1\frac{1}{4}$ in. thick with a plasterer's steel float. One or two planks of wood $1\frac{1}{4}$ in. thick should be used as a guide to maintain the layer at the correct thickness. A fair amount of pressure should be exerted on the float to compact the asphalt as much as possible at this stage. It will be found that the asphalt can be worked very much like stiff cement mortar. When thus laid, the asphalt will be a spongy, porous mass and will not be water-proof until it has been thoroughly tamped all over to consolidate it. After a period of one to two hours, it will be sufficiently cool and firm for this to be done. A little dry sand may be sprinkled over the surface, if necessary, to prevent the bitumen sticking to the rammer. The tamping, which is an essential part of the job, must be carried out systematically until the asphalt is thoroughly compacted, by which time its thickness will be reduced to about $1\frac{1}{8}$ in. Care must be taken to see that it is well tamped in the angle between the floor and wall, where it should be rounded to form a good joint with the wall, and also round the mouth of the outlet pipe.

Since the central guide pipe should be left in position until the wall has been completed, a small area round the pipe should be left until the pipe has been removed. The hole left by the pipe can then be filled in and covered with a patch of asphalt, which must be finished off flush with the surrounding surface so that it is not damaged when the last of the grain is being shovelled to the outlet pipe.

The method of mixing and placing the asphalt in small quantities is a little slow but is advocated for those who have had no previous experience in handling this material.

It may be mentioned that the above directions are only applicable to the making of a damp-proof floor which is intended to remain slightly plastic. An ordinary asphalt floor required to carry traffic would be constructed in a different manner.

When the floor has been finished, the building of the walls can be continued to the required height.

The Ceiling or Inner Roof. The purpose of the ceiling or inner roof is to make the bin weevil-, vermin- and thief-proof, and reasonably air-tight. It is not intended to keep out rain, for which purpose a separate outer roof is necessary.

The construction of the ceiling is clearly shown in the drawing. The two bearers, 6 in. to 7 in. in diameter, are set 2 ft. apart in the 9 in. brick wall. These form a support for the light poles, which may be from 2 in. to 3 in. diameter, and also provide a convenient means of constructing the man-hole. These poles should be as straight and uniform in thickness as possible, and should be laid close together with their butt and tip ends alternating so that a parallel arrangement is maintained. It is not necessary that the poles should be long enough to extend from one side of the bin to the other; in fact, it is better to cut them to such lengths that the ends meet over one of the beams. The shorter lengths of timber thus required will be straighter, there will be less difference in the diameter at each end and a more uniform thickness of timber will be maintained. There is no necessity to nail these poles to the bearers except immediately round the man-hole. This timber ceiling may now be made insect-proof and reasonably air-tight by sealing it with cement plaster or asphalt or a combination of the two. The corrugations between the poles can first be filled with 1-6 cement mortar finished flush with the top of the poles and worked in between the ends of the poles and the brick rim at the top of the wall. When this mortar is quite dry, it should be covered with a layer of asphalt about $\frac{3}{4}$ in. thick. The asphalt should be prepared in the same way as for the floor, but since it would not be practicable to tamp it, it should be placed in two or three thin layers, each layer being well pressed down with the float to consolidate it as much as possible.

If cement plaster or concrete made with very small stones is used alone it should be thick enough to cover the poles to a depth of 1 in. to $1\frac{1}{2}$ in. The objection to the use of a cement mixture is that if the poles warp or shrink, the cement may crack, whereas the asphalt, being slightly plastic, will maintain a permanent seal.

REINFORCED BRICK GRAIN BIN
Schedule of Quantities

Material	Capacity of Bin	
	150 bags	250 bags
Bricks for foundation and 9 in. wall	5,000	6,000
Lime mortar with 10% cement added for laying bricks:—		
Lime	6½ bags	7½ bags
Cement	6½ bags	8 bags
Sand	5 cu. yds.	6 cu. yds.
Cement mortar for grouting floor, plastering wall and filling timber ceiling:—		
Cement	4 bags	5 bags
Sharp sand	1 cu. yd.	1¼ cu. yds.
Wire, 12½ G. high-strain, steel	230 yds.	280 yds.
Damp course, Felt 3 ft. wide	18 ft.	24 ft.
Bituminous paint for floor	2 gals.	3 gals.
Asphalt floor:—		
Bitumen, Grade 80/100	12 gals.	18 gals.
Graded sand	10 cu. ft.	15 cu. ft.
Asphalt ceiling:—		
Bitumen, grade 80/100	8 gals.	12 gals.
Graded sand	7 cu. ft.	10 cu. ft.
Tar for walls and foundations	4 gals.	5 gals.
Man-hole cover, ceiling timber, outlet pipe	As required	

Notes.—(1) If all brickwork is laid in 1-5 cement mortar instead of the lime-cement mixture indicated above, twice the quantity of cement will be required.

(2) If the wall is built in 4½ in. brickwork the quantity of bricks and mortar required will be reduced by approximately one-third.

(3) The quantities of cement are given in bags of 188 lb. weight.

The Artificial Incubation, Brooding and Rearing of Chickens.

By H. G. WHEELDON, Poultry Officer.

(This article replaces Bulletin No. 1182 now out of print.)

Everyone engaged in poultry farming is confronted with the problem of raising young stock. The pivot point on which the success of the poultry farmer turns is his ability to renew the laying flock satisfactorily each year. The profitable period of a fowl's life is so short that it is necessary to raise stock for the laying pens every year, and the beginner finds this to be the most difficult part of the whole business, while success in this direction is most important. It is attained only by the intelligent application of correct methods. If the incubation, brooding and rearing of chickens are not carried out under such conditions as will produce and maintain both growth and good constitutional qualities, the mature stock will fail to produce or earn more than a nominal profit. A set-back during the life of the chicks may adversely affect their stamina, and the progeny of such stock, if raised under similar conditions, will be less valuable than the parents. With such deterioration the flock would become unprofitable in two or three generations. On the other hand, chicks from good stock, if given intelligent care and surrounded with the essentials required for proper growth and robust development, would mature into poultry capable of returning to their owner the last farthing in payment for the food and accommodation provided. Good methods and well grown mature stock increase the productive efficiency of succeeding generations and successful poultry farming is appreciably maintained.

The chick hatched for the market must make rapid gains. To do this in the shortest time assures the greatest profit, and the conditions and methods of rearing in some respects are artificial. The chick destined for the laying house, however, must be allowed to grow steadily without any set-back, and more natural conditions might be approximated with a view to raising stock robust in constitution. The young birds will then withstand the strain of consistent egg production, which is necessary to produce the results that count.

The building up of a strain of fowls involves something more important than the selection of standard requirements or prolific egg production, namely, breeding for health and constitutional fitness. Those who are successful in the business on a large scale have learned by experience that it pays to select only healthy, vigorous stock for breeding. Unless inherent, these qualities are less likely to be transmitted to the chicks, whereas constitutional defects may be reflected in several generations, with a tendency to increase rather than lessen in a given strain. The breeding stock should be sound in health and not too closely inbred.

The Breeding Stock. Select the breeding stock for health and constitutional qualities, then for desired qualities in other respects. Choose only the best for the breeding pens, even if a few birds only are used, and pen them with a view to offsetting minor physical defects by mating birds that are strong where the others show weakness. When the individual birds have been selected and penned according to ancestry, then house, manage and feed them with a view to maintaining health and profitable returns. Their requirements must be met and regular supervision is necessary. A comfortable shelter when needed from the rays of the sun and during wet weather; a fair variety of wholesome food; clean drinking water; always *a liberal supply of green food*, and suitably ventilated houses without draughts are the important essentials.

It is not sufficient to exercise reasonable care with the breeding stock alone; the careful handling of the eggs before incubation, during incubation and the management of the chicks to maturity are of equal importance. It is upon the common sense application of their requirements that the success of commercial poultry production depends. Lack of stamina is often the result of in-breeding, overcrowded quarters and unsuitable rations, which undermine the constitution of chickens.

Assuming then that the breeding birds have been carefully selected, well housed and supplied with their normal requirements, the next point of importance is the proper care of the eggs for incubation; this is where many poultry farmers unconsciously go wrong. Careless methods of handling and storage of the eggs for incubation and during incubation impairs the hatchability. Probably more chicks are found dead in shell or are weakly after hatching as the result of wrong methods of handling them than from any other cause.

Eggs for Hatching. Eggs intended for the incubator should be gathered once daily in cool weather and twice during the hot weather. Renew the nesting material often, handle the eggs with clean hands, place them in a clean receptacle, and keep them in a rack with small end downward, or if they are stored on their side, turn the eggs daily. Avoid excessive evaporation of the contents of the eggs by covering them with a cloth. The room in which they are kept should be fresh and cool, a temperature of about 60° F. is desirable. Wherever possible, they should be used for incubation before they are ten days old, as the germ weakens with age. Prolonged exposure of the eggs to a temperature of 80° or 90°, or frequent warming and cooling before incubation, may destroy the germ or will surely result in a weak chick. Select only the best eggs for incubation. Uniformity in size, shape and shell texture are important, and they should not be less than 2 ozs. or above $2\frac{1}{4}$ ozs. in weight.

Artificial Incubation. Artificial incubation may account for considerable losses, because the hatchability of eggs is so easily affected by machines carelessly operated or handled without sufficient knowledge of the work. It should be mentioned that with the modern systems of incubation good results are invariably obtained if the machines are managed with due care. There are various types and makes of incubators, such as moisture or tank machines and those embodying the hot air principle, each of which

gives satisfactory results. Mammoth coal-burning machines are available, and cabinet incubators embodying similar principles more recently introduced are heated either by blue flame or electricity. It is necessary to understand thoroughly the operation and conditions most suitable for these incubators by following the printed instructions accompanying each machine.

In choosing an incubator be sure of obtaining one of sufficient capacity to meet requirements. It is much better during the initial stages to incubate fewer eggs in a machine with reasonable greater capacity than to have a surplus of good eggs for hatching with only a limited incubation capacity. There are disadvantages also in extending the incubation season over a period of several months for the renewal of the laying flock. Adequate incubator capacity would ensure a given number of chicks over a shorter period.

Incubation may be successfully carried out throughout the year, especially when ducklings and chickens are intended for table purposes. The most seasonable and profitable period for hatching chicks of the heavy and light breeds for the laying flock is during May to August.

The most important points to consider in providing suitable conditions for incubation are uniform temperature, adequate moisture and ventilation in the room and freedom from excessive vibration. It is important that the incubator be level on a solid foundation or platform and the room suitably ventilated and controlled to provide a steady replacement of the atmosphere without excessive draughts. Strong currents of air may be controlled in windy weather by inserting hessian-covered frames in the open spaces provided for ventilation. The small type of incubator should be placed about one foot from the walls of the room.

After studying the instructions carefully and having set up the incubator under proper conditions, it should be operated without eggs for a few days, to become thoroughly acquainted with the details and for adjustments to the regulating device. An even temperature of 102° to 103° in the egg chamber is required during the early stages of incubation. The thermometers should be tested annually to make sure they are in order before incubation commences. The chief requirements in successful incubation are uniformity of temperature with adequate moisture and ventilation. It is advisable to fumigate the egg chamber with formalin after each hatch.

The possibility of disease during incubation can be minimised by fumigation of the egg chambers, which is a desirable precaution also in the case of purchasing second-hand machines. For fumigation, the ventilators should be plugged or strips of paper pasted over them, wet the interior of the compartments with water and then insert a saucer or shallow tin containing permanganate of potash crystals with double the amount of commercial formalin poured over the crystals; 1 oz. formalin to ½ oz. permanganate of potash would be sufficient for every five cubic feet internal measurements; close the machine and maintain its operating temperature for a few hours. After fumigation, leave the machine open to air before placing in the eggs.

Having fumigated and thoroughly mastered the operation of the machine and maintained a uniform temperature in the empty

incubator, fill the trays. The eggs should be left for several hours to warm up, when the temperature will automatically rise to about 103°. After 24 hours the eggs should be turned and aired, and this should be done at regular intervals throughout the period of incubation.

There are no infallible rules for operating an incubator. The amount of moisture and ventilation required, the manner of turning and cooling the eggs and other details cannot be definitely stated for all machines. These are subject to variation according to the type of incubator and climatic conditions. The mammoth machines and some of the smaller incubators are equipped with a turning device and printed instructions for their operation accompany each machine. The usual method of turning eggs by hand in small incubators is to remove the eggs in the centre of the tray to the side or end of the rows, and gently roll those at the side to the centre of the tray. This method may be adopted for turning and cooling the eggs in the morning, but in the evening give each egg a quarter or half turn, then close the drawer without cooling them. As to the length of time the eggs might be left to cool, no hard and fast rule can be given; this must be left to the discretion of the operator. In hot weather, however, when the temperature of the incubator and the room tends to rise, the eggs may be cooled from five to fifteen minutes longer than under ordinary conditions, remembering always that during the last week of incubation eggs also require more air than they do during the first ten days. Under ordinary conditions the eggs are aired and cooled during the early stages of incubation sufficiently to give best results while they are being turned. A point of great importance is to turn the flame of the lamp very low during the time the eggs are being cooled. The embryo chick generates animal heat as soon as it commences to develop, and the volume of warmth increases steadily during the period of incubation. This is the reason why the temperature usually rises during the last week or ten days, and it may be necessary to reduce the flame of the lamp very considerably or to readjust very carefully the regulator during this period. It is inadvisable to tamper with the regulating device during the hatch, but it must be done if, after lowering the flame, the temperature tends to rise above 105° F.

The normal periods of incubation are as follows:—Fowls, 21 days; domestic ducks, 28 days; muscovy, 35 days; geese, 28 days; turkeys, 30 days; guinea fowl, 26 days; English pheasant, 26 days.

The eggs may be tested twice during the period of incubation, the first test on the seventh day and the second on the fourteenth day. At the first test remove all infertile eggs, broken yolks and dead germs. Mark those which may be doubtful and continue to incubate them until the second test. If they do not develop further by that time they should be removed, as well as all other dead and weak germs and addled eggs. Turning of the eggs should be discontinued on the morning of the twentieth day, or sooner if the chicks begin to hatch. On the morning of the twenty-first day gently remove empty shells and place the hatched chicks in the drying box, or, as provided in some machines, in the nursery trays, and allow them to dry off for twenty-four to thirty-six hours, when the chicks should be removed to the brooders. The brooders should

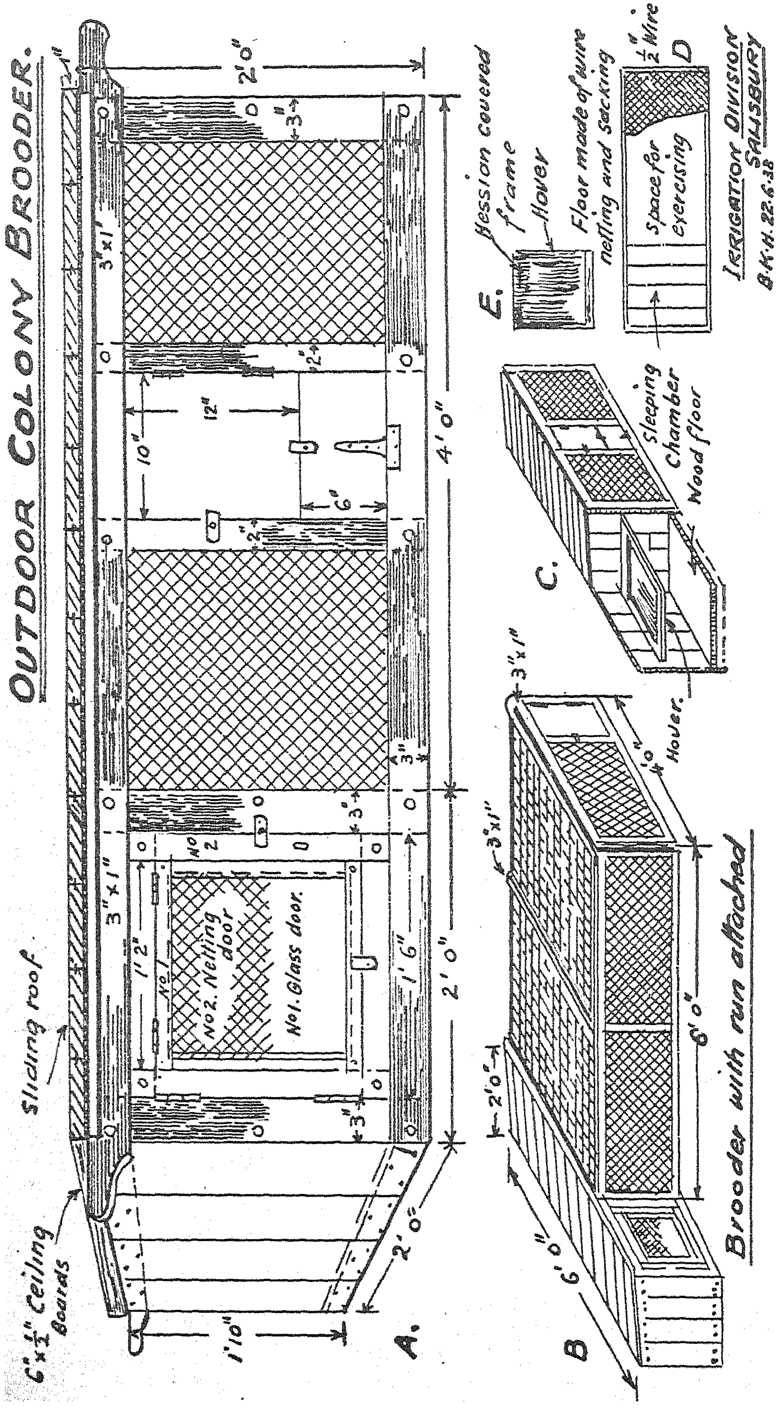
be thoroughly cleaned and littered with grass. Fireless or cold brooders should be placed with the chicks in a sheltered, sunny locality, taking care to provide shade when required. From this stage until a few days old the chicks will require frequent attention, and it is important to avoid excessive exposure during the early morning and evening to avoid chilling. The activities of the chicks will indicate plainer than words whether they are comfortable or not. If crowding together and chirping, their usual requirement is warmth. Close observation and careful management will ensure good growth to marketable age or maturity of a large percentage of the chicks placed in the brooders after hatching.

Artificial Brooding. Artificial brooding is comparatively simple when the requirements are thoroughly understood. Although constant attention and observation are necessary, any system other than artificial brooding in the case of chicks hatched and raised on a commercial basis would be too laborious and out of the question. The main object is to provide facilities for protection and to keep the chicks warm and comfortable during the early stages after hatching. They should be kept under control and provided with conditions to encourage good health and robust development. The care and attention given to chicks during the first few days, the critical period of their life, determines to a great extent their future value. The most satisfactory and economical types of brooders are generally those that are portable.

There are two types of artificial brooders, both of which have proved satisfactory and adaptable to the requirements of the poultry farmer for brooding chicks in either small or large units. They are the fireless or cold brooder (a misnomer) and heated brooders, the greatest essentials being efficiency, convenience, economy and safety.

Fireless Brooders. The drawback with most brooding systems is the cost. The need of an efficient, convenient and economical means of brooding chicks in small units is a matter of importance to many poultry keepers, and for this purpose the fireless or cold brooder, such as is shown in the accompanying design, is advocated. The outdoor colony brooder is easy to construct and handle. It affords the necessary protection from vermin and can be moved to fresh ground as often as may be necessary. The capacity of this brooder provides for 50 chicks without artificial heating. This system has been practised for a considerable number of years with satisfactory results in this Colony. Heated brooders are not necessary for brooding chicks in small units in warm localities. Suitable arrangements could be made to equip this brooder with a temporary heating device in the case of emergency when the chicks are to be removed from the incubator during a spell of cold, cloudy weather. This requires careful attention, however, to avoid overheating the chicks and heating devices are not generally necessary.

The brooder must be thoroughly clean and the floor littered with grass or straw. The interior of the brooder chamber should be thickly lined with long grass on all sides to provide a fairly deep nest in which to brood the newly-hatched chicks on removal from the incubators and at night. The hessian-covered frame or hover is placed over the nest and pressed down to about one or two inches above the chicks in the nest. As the chicks require more


OUTDOOR COLONY BROODER.
Sliding roof
6" x ½" Ceiling Boards
3" x 1"
No 2. Netting door
No 1. Glass door.
A.
B
C.
D
E.
Hession covered frame
Hover
Floor made of wire netting and Sacking
½" Wire
Space for exercising
Sleeping Chamber
Wood floor
Hover.
Brooder with run attached
IRRIGATION DIVISION SALISBURY
B.K.H. 22.6.38

room and ventilation, so the nesting material should be reduced until only sufficient grass is left to round off the corners and support for the hover. The hover can be raised in this way as the chicks increase in size, and finally removed when they are reasonably well feathered. This hardens them off before their transfer from the brooder at five to six weeks of age.

The chicks should be confined to the hover section most of the time during the first day or two, especially if the weather is unfavourable; the position of the brooder should be adjusted periodically so as to admit the sun to the interior of the brooder all day if possible. From the third day they can be confined to the exercising apartment to a greater extent with access to the brood chamber as they require it and later allowed in the attached wire run. During the first two or three days when the chickens are confined to the hover section, it must be lifted several times a day at regular intervals for feeding the chicks, but the chicks must be replaced under the hover after feeding before they become chilled. By frequent handling in this manner the chicks soon learn what is required of them, and may soon be trusted to take care of themselves when they require warmth. If they show any disposition to crowd or huddle together outside the brooder chamber at any time, place them under the hover to warm up. When they are a week old they may be allowed access to the wire run. A covering on top of the run is necessary for shade in the absence of shade from trees. Not more than 50 chicks should be placed in this type of brooder, as it is considered the maximum limit of safety. Care must be taken to keep the chicks warm and comfortable at all times, and to provide ample ventilation for them at night. Overcrowding under the hover with insufficient ventilation, especially at night, will definitely impair the vitality of the chicks and will lead to respiratory troubles, stunted growth and mortality. Overcrowding is as harmful as supplying unsatisfactory rations.

The chicks should be given the opportunity of exercising in quarters that are not too cramped. They should be provided with sufficient hopper space to allow easy access to the food and water at all times during the day. Sun and air the hover compartment daily when not in use, as well as the litter. The litter should be renewed as often as may be necessary, generally twice a week.

Heated Brooders. Of the many types of heated brooders the oil-burning, electrically-heated and battery systems are probably the most commonly used, and to a less extent the hot water pipe system. There is also the flue system and coal-burning brooder stoves for heating the entire apartment for brooding chicks. All these methods of providing warmth are giving satisfactory results. Heated brooders and apartments must be suitably ventilated.

They are as a rule centrally heated, and in the case of brooder stoves the heat generated is greater than the chicks require. The room must be large enough to provide sufficient floor space to allow the chicks to regulate for themselves the distance from the heater or degree of warmth they require. The room should not be allowed to become stuffy and oppressive during the day through lack of ventilation. Such brooder apartments should be provided with facilities for ample ventilation during the day, and to a less extent at night. The zones of heat varying in temperature on the floor

level at night enable the chicks to choose the temperature most comfortable to them by spreading out on the floor of the room. The room temperature for battery brooders on a large scale may be automatically regulated and controlled.

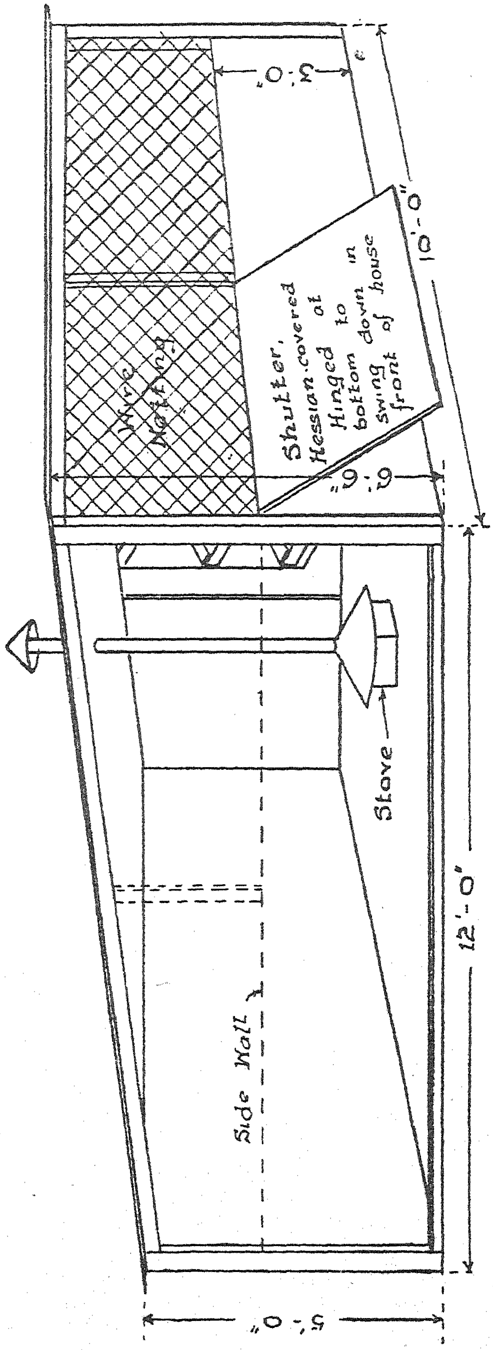
The oil-burning, electrically-heated and hot water systems are generally adaptable to the hover or box and canopy design of brooder. They provide a minimum heating capacity to keep newly-hatched chicks warm and comfortable, and are more practicable and economical for brooding chicks in units of moderate size. They meet, with practically no exception, all the requirements laid down for satisfactory brooding and may be placed in any convenient building or in a brooder house designed and equipped for that purpose. Where brooding is undertaken on a large scale with heated brooders, a special brooder house is necessary, which must be designed to fulfil the requirements of the heating system to be adopted.

Brooder House. There are three types of brooder houses generally used for the successful rearing of chickens. They are:—

1. The portable or colony house.
2. A long permanent building sub-divided into pens having either a built-in or portable heating system.
3. Permanently built house for brooder stoves.

1. Colony brooder houses installed with a portable heating system should be made as large as can be moved conveniently. A house 10 ft. by 12 ft. should be the minimum for units of 300 chicks. A suitable size for units up to 500 chicks would be 14 ft. by 16 ft. A lean-to roof at least 6 ft. 6 in. in front and 5 ft. at the back should suit a house 12 feet deep, and an uneven span or apex type of roof would be more satisfactory for a house which is 16 ft. deep, the height of the walls being 6 ft. and the roof at the apex 7 ft. 6 in. The accompanying design (Fig. 2) illustrates a brooder house which is considered satisfactory for this purpose. It can be moved conveniently on most farms. The house consists of a wooden frame with water-tight roof. The sides, back and front should be covered with wire netting, attached to the inside of the framework. The back wall and lower part of the sides and front should consist of some light weather-proof material, such as galvanised sheet iron, malthoid or rubberoid, etc. This should be 3 ft. high on the sides and front wall. The openings above this may be fitted with hinged wooden frames covered with fine hessian, hinged at the bottom to swing down on the outside of the house. These shutters may be closed for protection when necessary or opened for ventilation and to admit sunshine as may be required.

2. A brooder house constructed of bricks for built-in or portable heating systems should be 12 ft. deep with a passage 3 ft. wide along the interior of the back wall. The house should be sub-divided by wire netting partitions 6 ft. apart for units of 100 young chicks and sub-divided into larger sections when the brooding of larger chicks is intended. A northern aspect is preferable. Outdoor wire runs should be provided to coincide with the internal sub-divisions of the house. An open-fronted house of this type can be operated successfully in some localities, but provision should



PORTABLE BROODER HOUSE, WITH BROODER STOVE

[Side of House Removed.]

be made to minimise ground draughts by solid dwarf partitions 12 ins. high and with hinged cloth-covered frames for closing the open front when desirable in cold weather. In cold climates the front of the house should be enclosed with glass windows to afford the protection necessary. In planning a brooder house, consideration must be given to convenience in attending to the chicks, inspecting the hovers, feeding and watering, disinfecting and cleaning.

3. For brooding chicks in large individual units, proper facilities are required which entail the provision of equipment most suitable for this purpose. The types available would be heated battery brooders, and the canopy type of brooder stoves, or a combination of battery brooder with other systems deserve consideration. Battery brooders are compact and may be housed in almost any convenient room. A room suitable for a canopy coal-burning stove with a capacity for 1,200 chicks would be 25 or 30 ft. long and 15 or 18 ft. deep, respectively, suitably e closed in front. Runs at the back and front of the house shoul be provided for alternate use and with four exits or trapdoors in the walls to each run.

A system of battery brooding for large numbers of chicks immediately after hatching, combined with other heated systems such as may be in existence, to be used for the chickens as they become stronger, would be of considerable advantage. Battery brooders electrically heated are reliable, economical in fuel and easy to operate. They are extremely useful during the early stages up to three weeks of age from hatching. They facilitate the safe handling of chickens in large numbers during their early life when the conditions required by them are definitely more exacting. As the chicks become stronger they are better able to fend for themselves and withstand the conditions on being transferred to the brooder houses such as those equipped with other heating devices in which the sub-division of chicks in smaller units is practised.

Ventilation and Temperatures. The importance of adequate ventilation in the brooder house and brooders cannot be too strongly emphasised. Adequate ventilation of the brooder house itself does not necessarily ensure sufficient ventilation under the hovers; these must be provided with facilities to permit a free circulation of air.

With heated brooders the temperature is another important factor. Insufficient warmth induces crowding and is harmful; overheating, due to lack of ventilation, causes sweating, resulting in respiratory troubles, which impair the vitality of the stock. These conditions are particularly observed under hovers equipped with strips of cloth or curtains that hang close to the floor and which restrict the circulation of air. When used, the ends of the cloth should be at least 2 ins. from the floor. In operating such brooders, additional ventilation and a reduction in the temperature as the chicks grow older must not be overlooked. At the start, the temperature in the brooders should be 90° to 95°, and this should be gradually reduced to 65° at the end of the second week. Later the chicks should be brooded without artificial heat for a time before transferring them to outside quarters.

Brooder Management. The brooder should be ready for the chicks at least two or three days before the chicks arrive. If it is a new brooder with regulating device, make sure it is properly adjusted and that it works freely. The capacity of the brooder

should not be exceeded. When too many chicks are brooded together proper control of the young stock and access to the food hoppers are not always possible. Do not attempt to brood chicks of different ages in the same flock under the same hover. The brooder house floor should be lightly covered with coarse, clean sand for large heated brooders, and only a section of the floor of the room partitioned off with boarding in which to place scratching litter, such as chaff or cut grass, to a depth of 2 ins.

With heated brooders the liberty of the chicks should be at first restricted, confining them within a reasonable radius from the hover by a temporary wire netting screen for the first few days. Advantage should be taken during this period to train the chicks to return independently to the hover for the warmth and protection they require. They will soon learn to take cover, and as they become older and more independent they should be given more room to exercise, and after the end of the first week the whole of the floor space should be accessible to them. At this stage the chicks may be allowed out into the outside runs of the brooder house during fine weather. Observation is necessary on the first occasion, as they may not be able to find their way back into the brooder house. Sanitation and cleanliness under the hovers and in the brooder house are very essential for health and the sturdy development of young stock. The brooder compartments should be thoroughly cleaned and disinfected after the removal of chickens.

Chickens at 5-6 weeks old are generally well feathered, and they should be removed either to outside coops confined in pens, or reared under the colony system. On transferring them to their new quarters they will require some attention for several evenings to accustom them to their new surroundings. This attention would be amply repaid and is necessary to obviate overcrowding and possibly mortality. They should be accommodated in units of 50, or a maximum of 100 chicks, and separated according to sex. Perches are not necessary at this stage, but the floor of the house should be well littered and the corners rounded off with grass, or preferably with wire netting, to prevent corner-crowding. As the chickens develop, the accommodation should be increased, or the number of chicks reduced, according to the size of coops in which they are accommodated.

Feeding. The proper feeding and management of the young stock determines to a great extent their future value as breeders and layers.

Growing birds want variety, if for no other reason than to maintain their appetite, and there must be no stinting of food, although waste must be avoided. There is an axiom in the management of stock that the "feeding must be above the breeding" if improvement is to be obtained. While it is true that improved results would be secured by sound methods of feeding, it is equally true that still better results would be obtained by having the stock properly bred and properly fed. In this way the greatest return would be derived from a given amount of food.

The object of the poultry breeder to-day is to economise in almost every branch of his business, but there is one place where stinting is false economy, and that is in the supply of food. It is

much better to hatch fewer birds and feed them well within one's means than to try and raise a large number that may be undernourished.

The successful feeding of chicks is not a difficult problem, provided they are supplied with their natural requirements. Almost any wholesome nitrogenous ration made up of grain and grain by-products, green food and animal food given regularly is what they require in the way of food, and they must always have access to clean water and grit.

The chicks will be ready for their first food 36 to 48 hours after hatching. It is necessary to bear in mind that the newly-hatched chick, by absorption of the yolk of the egg just prior to emerging from the shell, has been provided by nature with sustenance for the first 48 hours after hatching. Feeding, therefore, too soon after hatching is not only unnecessary but undesirable, and may prove harmful.

The food should be given preferably when they have been removed from the incubator to the brooder. They should be provided with shallow vessels each containing dry mash, water and a little grit. Two or three pieces of straw may be allowed to float on the surface of the water, which the chicks will pick at, and soon learn to drink. At frequent intervals during the first two days their attention should be drawn to the food, either by tapping the food with the forefinger or by taking a pinch of the mash between the fingers and allowing it to sift down from a few inches above the food tray. By these simple means chicks can be taught to eat and will soon learn to care for themselves. A small quantity of pinhead oatmeal may be given twice a day as an additional feed during the morning and evening. From the third day a little munga or commercial chick food may be given in conjunction with the dry mash, substituting the oatmeal and feed at frequent and regular intervals during the course of the day.

The best results are obtained by the dry mash system of feeding, either combined with grain or fed as an "all-mash" ration without the use of grain. An all-mash ration simplifies feeding and the stock make greater gains in weight as a rule; when it is desired to feed grain with dry mash, it can be done by substituting grain for portion of maize meal.

When the feeding of moist food is adopted, the mash should be mixed to a crumbly constituency with separated milk or warm water, and the chicks given only sufficient to be consumed in half an hour. The food left over after that time should be removed until the next feed. Moist mash may be fed in conjunction with dry mash as a regular system in the rearing of table birds. For stock that are intended for the laying and breeding pens, however, the mash in a moist state should be regarded as supplementary, especially for late hatched chicks and chicks that have gone off their feed or flagging. A moist mash as a change stimulates the appetite and encourages a greater consumption of food and maintains good growth and development. Grit and water are necessary at all times, and finely cut tender green vegetation must be given daily. Bone meal, lime and salt as a mineral mixture may be incorporated in the mash for all ages of growing stock. Separated

milk, when available, is a desirable addition given either mixed with mash as a moist food or the curd given in separate receptacles. It is better to give the curd after draining off the whey when milk is supplied separately.

The grain mixture or munga should be fed in loose litter, which will induce the chicks to exercise by scratching for it. Feed the grain four times a day in small quantities at regular intervals for young chicks. As the chicks grow older, accustom them to a larger range or run, placed with the brooder on grass-covered ground. The site which has been set aside for rearing should be planted preferably with a permanent grass such as couch. This serves to sweeten the land during the off season and furnishes green pickings for the chicks and two or three cuttings of grass of desirable length during the rainy season for use in the brooders.

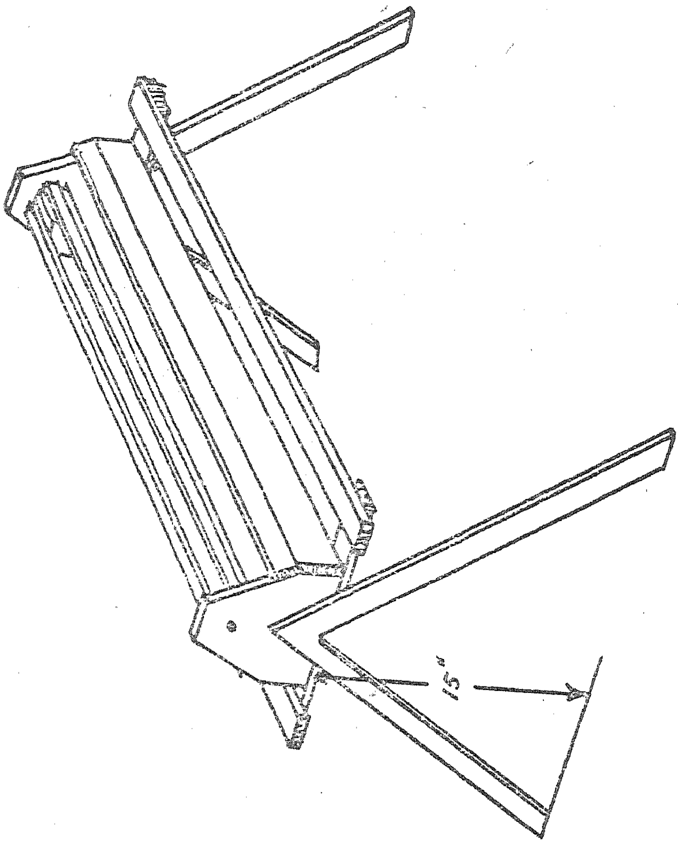
When the chicks are eight weeks old give them a mixture of larger grain, such as cracked wheat or crushed mealies mixed with munga and small sunflower seed. By the time the chicks are six to eight weeks old the principal dangers of chickenhood are past, and at this stage they may be removed or weaned from the brooder to suitable coops. The rearing can be continued in wire runs or by the colony system.

The chickens may, when old enough, be allowed free range under the colony system where they can have freedom under natural conditions, but they must be provided with nourishing food *ad lib.* to ensure steady, healthy, continuous growth. Guard against insect vermin and keep the coops clean and dry.

Chickens intended for laying or breeding purposes should be carefully selected when young, the first selection being made when they are eight weeks old. Separate all the cockerels and house them separately from the pullets. Those showing retarded growth should be separated from the more robust ones and placed in a pen for fattening. A regular practice of culling the young stock is advocated, by which essential economies may be effected. The stock showing evidence of lack of stamina and the cockerels having standard defects should be drafted from time to time to the fattening pens for disposal.

Dry mash hoppers are of the greatest advantage in feeding poultry of all ages. By using hoppers for the dry mash, time and labour will be saved. This method of feeding is the cleanest, easiest and best way to feed poultry. The hoppers should be replenished daily, or, in the case of self-filling hoppers, less frequently, depending upon size of flock. The chickens should have access to the food all day, and sufficient hopper space must be provided to enable all the chickens to feed comfortably without overcrowding and molesting each other. Double-sided hoppers are recommended, 4 ft. long for 100 chicks, and an intermediate size for half-grown stock should be 6 ft. long. The size of hopper accommodation required should be based on the equivalent of one inch per bird.

The value of green food throughout the whole year cannot be too strongly emphasised either in a fresh succulent form or supplied as leaf meal in the mash. Leaf meal may be soaked in water for an hour and fed to the birds after draining in place of succulent green food.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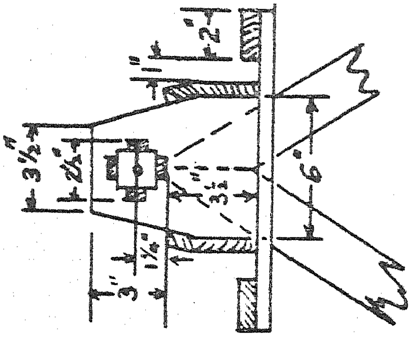
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At the age of five months on reaching laying maturity they should be fed on a mash and grain mixture for adult stock.

There are so many grains and meals obtainable in Rhodesia which are suitable for feeding to poultry that a good ration may be made up to suit the poultry farmer from the variety of foodstuffs available. The accompanying rations consist of foodstuffs that are generally easily available and have proved satisfactory. The digestibility, general analysis and palatability of the constituents are important and must be taken into consideration in compiling efficient rations. Other farm-grown foodstuffs may be substituted, but they have been found less palatable and more indigestible as a rule. To supply young stock with food that does not furnish the necessary nutritional requirements or that is not palatable and of good quality is wasteful or would seriously retard their growth. In the case of laying stock, lowered productivity would be the result.

During the early stages the rate of growth of the chick is chiefly limited by its capacity for the consumption of food, and although there is at present no data available by which to determine the exact requirements of the chick for protein and carbohydrates, it has been found there is little possibility of over-feeding a chick in its early stages of growth and that the food mixtures usually given to chicks during the early stages are deficient in protein.

The following ration based on these observations has given excellent results. The chickens grow and feather more quickly and the rearing mortality is reduced to a minimum.

With a view to simplifying chick rearing, the following ration was tested at the Salisbury Experiment Station, where it has since been used for a number of years in the rearing of light and heavy breeds of fowls. The results have proved so satisfactory that this ration can be recommended.

CHICKEN REARING RATION: HATCHING TO MATURITY.

Mash Mixture.

Bran	10 lbs.
Pollard	17 lbs.
Mealie Meal	45 lbs.
Oats (rolled or meal)	10 lbs.
Meat or Fish Meal (to 12 weeks)	10 lbs.
Monkey Nut Cake (ext.)	10 lbs.
Milk, thick, separated, if available, to 10 weeks (optional).	
Bone Meal	2 lbs.
Salt (fine)	½ lb.
Lime (limestone or powdered oyster shell)	1 lb.
Charcoal	1 lb.

Grain Mixture—From 8 Weeks.

Crushed Maize	60 lbs.
Munga	30 lbs.
Sunflower Seed (optional)	10 lbs.

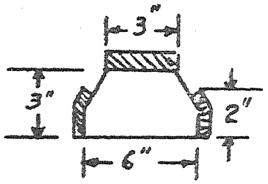
The above mash may be fed alone during the early stages of growth, or in addition munga as a grain feed may be given from the first week to 8 weeks old; thereafter add crushed maize and small sunflower seed, the latter being optional.

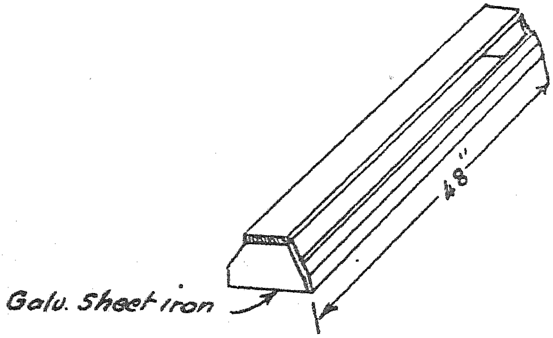
From 12 weeks onwards omit meat or fish meal, the other ingredients remaining the same.

When thick separated milk is available, reduce the meat meal to 5 lbs. In the event of oats being too costly, substitute by increasing the maize meal and bran each by 5 lbs.

A liberal supply of green food is essential for all ages of growing stock, especially when white maize is used. Part may be mixed for convenience in the mash in the form of lucerne or sunflower leaf meal in addition to succulent green food given daily.

General Observations. The mortality of young chicks is not always due to disease and parasitic vermin; losses may occur from several other causes which are often overlooked and can be forestalled.





Overcrowding and Chilling. The brooding of chicks in quarters that are comparatively restricted is accompanied by some danger of overcrowding and suffocation. When the chicks are too cramped and without sufficient ventilation suffocation may result, particularly at night. Overcrowding occurs also outside the brooder during cloudy weather and chilling may result, such as when they are unable to find their way back to the brooder chamber; also young chicks that are exposed too long at sunset or exposed too early in the morning may become chilled. It is particularly im-

portant to avoid possible chilling during the day and overcrowding at night when the chicks are very young.

Another source of danger arises on removal of the chickens from the brooders. During the first few nights careful observation would be well repaid, as they will crowd together, especially in chilly weather, or they may not find their way back into the new quarters. If left outside overnight, mortality will result. At this stage overhead protection placed about 2 ft. above the floor, to take the place of the hover, and having the corners of the pens rounded off, are necessary precautions to avoid losses.

Bowel Trouble. The derangement of the digestive system of young chicks is caused by a number of conditions, including chilling, improper feeding, sun-warmed water, overheating or stale and inferior quality foods. Digestive disorders during the early stages of growth may be the result of feeding the chicks too soon after hatching or of allowing them access to moist mash that has fermented. Always supply clean water, fresh, wholesome food and provide shade for the chicks and drinking water.

Sanitation. Sanitation checks disease and must be regarded as one of the important considerations in successful chick rearing. Many common diseases and troubles of both old and young stock can be avoided by following sanitary principles. Proper sanitation means raising chicks on fresh ground, moving portable brooders from place to place at intervals, or, in the case of permanent runs, digging them over and growing a crop during the off season. Contaminated ground should be treated with lime during the rainy season. Renewing the litter in the brooders as often as necessary and consistent cleaning of utensils and disinfecting brooders after each lot of chicks are weaned are essential points in sanitation.

Cannibalism or Toe-Picking. This is frequently very difficult to deal with, and when an outbreak occurs every effort should be made to nip the trouble in the bud. As a rule, one or two birds are the culprits, and others simply join in the feast, and it is only by close observation that the ring-leaders may be detected, and if removed in time it is possible no further losses would occur.

Cannibalism is often associated with poor hatches and unthrifty stock. The latter may be brought about by too close confinement in the brooders and runs followed by monotony or by providing insufficient hopper accommodation. Under such conditions the tendency for the chicks to peck and bully and injure one other is greater. These are the most common causes of cannibalism, and the danger under these circumstances becomes a very real one.

Much of this trouble can be avoided by furnishing the chicks with proper nourishment and brooding them in smaller units. There should be no delay in culling the weak stock, separating the sexes and transferring them to larger quarters. Anything that can be done to keep them busy deserves consideration, such as encouraging them to forage about in the runs, the feeding of grain in litter and hanging up in the runs several bunches of green food within easy reach. These are methods to encourage scratching and exercise, and in this way healthy chicks are produced.

Some Trees, Shrubs, Shrubby-Herbaceous Plants, Climbers and Water Plants.

SUITABLE FOR THE COLONY.

By J. W. BARNES, Manager, Government Forest Nursery, Salisbury.

(Photographs by the Author.)

(This replaces Bulletin No. 1267 now out of print.)

The following list of trees and plants has been compiled from twenty-three years' experience of horticulture in the Colony. These trees and plants have been actually grown by the writer or have been carefully watched by him.

A large number of species has been tried at the Forest Nursery, Salisbury, during the past twelve years and experiments have been carried out with over one thousand kinds of seeds. The failure of quite a number of these seeds to germinate is attributed to the seed having been too old or to the lack of glass frames in which to raise new or sensitive seeds, which frequently arrive during the colder periods of the year. During the hot or summer season torrential rains are sometimes the cause of seed being washed away or seedlings being damaged.

The list is a comprehensive one and provides useful kinds for all parts of the Colony, and will, no doubt, be of value to people desirous of planting for timber and ornament. This article is more particularly directed to the landscape, or horiticultural side of the subject, and one cannot help being struck by the fact that, in this country of large holdings, more is not made of a proper lay-out round homesteads than is the case at present. Most people seem contented with a small shrubbery of formal aspect, whereas much better results would be obtained from a more generous treatment of the subject.

Where there is sufficient space large shrubberies could be laid out, care being taken not to have many straight lines but rather to employ curved banks of shrubs and trees backing lawns, or even the ordinary veld grass, kept cut by the mower.

A judicious use of the larger trees, such as *Cupresses torulosa, Eucalyptus citriodora*, and others will help to break up the formal look and give the lay-out a natural appearance.

Shrubs and trees for ornament are usually planted too closely together. Near the edge of the shrubbery should come the smallest growers, which may be planted at six feet apart, and farther back the larger shrubs which will require more room and

may be planted from ten to fifteen feet apart. If large trees are to be planted they will require wider spacing. However, all this is dependent on the effect required. If large splashes of colours are required, or deep masses of green, three or four plants of each kind may be planted from six to ten feet apart according to species, in clumps, but care should be taken that each species has room enough to develop properly. When first planted a shrubbery will have the appearance of having too few plants in it, but in a year or two it will be found that the ground is more or less covered.

Preparation of soil for planting is important. Where a plough can be used the soil may be turned up as deeply as possible and should be worked to a depth of eight to ten inches. Even with deep ploughing it is advisable to dig holes eighteen inches square and the same depth, filling in with good surface soil in which some old manure has been mixed.

The soil should be allowed to settle for a month or two. Care should be taken not to plant too deeply. The roots should be just covered. A good soaking of water if the weather is dry is necessary after planting, and grass thrown over the plants for a day or two will help. It should be remembered that plants are living things and can easily be killed, but when treated with respect they will be a credit to the grower.

It does not seem to be generally known that most flowering shrubs prune well, and that good results are obtained by judicious pruning. This operation is best carried out in early September, or just as the buds of Spring growth are breaking. It is a mistake in this hot climate, without a well defined dormant season, to prune shrubs or roses as early as May or June. They should be induced to rest as long as possible by withholding water and pruning. The result of early pruning is to start new growth prematurely and hence the short and unsatisfactory lives of some kinds.

In pruning shrubs it is not necessary to cut back severely unless the future effect would warrant it, and pruning should always be carried out with an eye to the effect desired at the time of flowering. In some cases, only long straggly growth need be shortened.

After the annual pruning there should follow a general dig-over, when the soil is broken up to a depth of at least three inches. It should be left in a rough state to enable air and early rains to penetrate.

Manure should be dug in round the plants within a radius of five feet of each, using it generously if sufficient is available.

During summer months it will be necessary to clean up weeds; these may be hoed up and buried in the shrubbery where in time they will become valuable food for shrubs. Arboreta, or shrubberies, are much the cheapest way of beautifying a homestead, and much less upkeep is required than for the same size of flower garden. This does not, of course, mean that one should dispense with a flower garden. A properly laid out

shrubbery will enhance the flower garden, in providing good backgrounds and wind breaks.

A good dressing of lime about every fifth year is beneficial. At least one ton of lime per acre should be used, and in addition common salt in the proportion of one to three of lime is recommended. When lime is used kraal manure must be left out, as these must not be used together.

Hedges. Most hedging is planted at one foot apart for single line hedges. Single line hedges are the rule, but double row hedges can be used if extra width is required.

The preparation of the trench is important, and will make all the difference between success and failure. Trenches eighteen inches wide and the same depth should, if possible, be dug three months before planting and should be filled in with good surface soil. Subsoil removed from the bottom part of trench should be discarded. Old manure, leaf mould, etc., mixed in the soil will be very beneficial. The trench should be filled in as soon as possible, and left raised about three inches above the surrounding soil level. In two or three months it will have settled down to the proper level, and is then ready for the plants. If the soil is dry at the time of planting a good soaking overnight will put the soil into good planting condition.

The after-treatment of hedges is important. In the case of coniferous hedges, such as Callitris, Cupresses, etc., they may be allowed to grow to the height required before having their tops cut off. Future work with these will be the shaping of the sides as the hedge thickens out and keeping the top cut neatly. In two or three years an excellent and close hedge will result.

With such subjects as Privet, Bottle Brush and Dodonea, the plants require topping when they have become established and half of the top growth should then be removed. Thereafter topping should be a regular operation and as the hedge grows a foot from the last cut, it should be again cut back half way. In this manner a good thick hedge will be built up and will not show bare unsightly sticks at the base. Camphor laurel should be treated not quite so severely as the former kinds. It is a good plan to take the smallest healthy plant in the hedge as a guide, and to shorten back the growth of the others, so that all are brought on about the same size.

All of these hedges are recommended to be planted at one foot apart.

The Bougainvillea, Macartney Rose and Golden Shower make excellent hedges, and make a delightful show when in flower.

The Bougainvillea planted at six feet apart will make a thick hedge, the long shoots as they grow must be tied into the fence wires, and spaced evenly about six inches to a foot apart so as to cover all the space. After the frame work is built up, future treatment will be the clipping off of all growth not required, which is usually done in such a way to keep the hedge about a foot or two wide.

The Macartney Rose can be treated as the Bouvainvillea and planted at the same distance apart. This is a particularly fine

thorny hedge, and excellent round orchards and places where it is required to keep out cattle. If no blank spaces occur in the hedge nothing will penetrate it. The Macartney Rose makes a cheerful sight in early Spring with its large white single flowers.

Both the foregoing hedges must receive regular attention and as a result will always look neat. If, however, they are neglected they become very unsightly.

The Golden Shower may be planted at nine feet apart along a fence, in large well prepared and well manured holes. As the plants grow the leading shoots can be tied-in, erect to the top of the fence, and then tied down along the top strand of wire as it grows until it reaches the next plant; side shoots from this main stem will then droop to the ground and make a fine showy and neat screen.

Avenue or Street Trees. The tendency of the past has been to plant street or avenue trees too closely together, and to allow them to branch too near the ground. Such trees as Cedrela, Jacaranda and Flamboyant need to be at least thirty feet apart, and the Flamboyant could be planted at 35 to 40 feet with advantage, as it is naturally a flat topped and wide-spreading tree.

For street planting especially, these trees should be grown with a clear stem to at least seven feet high, before being allowed to form a crown.

The practice in past years has been to let street trees branch more or less where they liked, the consequence being that some trees have formed a crown about four feet from the ground, while others, particularly the Jacaranda, have run up to nearly ten feet. In these days of fast motor transport these trees constitute a real danger, as a clear view is often obscured by low branches. The danger is increased at night. In Salisbury a lot of the trees have had to be pruned severely with the consequent spoiling of the appearance of the trees, however skilfully done. This would not have been necessary had the trees been grown correctly in the first instance. The Flamboyant (*Poinciana regia*), which is now being largely planted in streets is, as has already been remarked, a very wide-spreading tree, and is very inclined to branch near the ground, unless the branches are removed well up before allowing the crown to form. The Flamboyant may have to be removed in a few years, except in very wide streets.

From experience gained in the past we should endeavour to improve our cultural methods.

Cedrela and Jacaranda can be kept in shape by pollarding all straggly branches. An annual cut back of these would improve their appearance considerably, and prevent branches from encroaching on private stands, and would also keep the tops of the trees in uniform shape. It should be borne in mind that street or avenue trees are meant to provide shade and beauty and when they reach this stage they should be regularly kept in order.

The Spathodea is not so rank-growing as the former. It should be planted at twenty-five feet apart, and taken up to seven feet before heading, and large straggly shoots may be shortened after flowering.

The Bauhinia is not so large and can be planted at twenty feet apart and planted where it can be allowed to form low branches, but it is not really suitable alone. It may be planted as a front line in wide roads where two lines are required and where there is plenty of room between the curb and sidewalks. It would be a pity to discard this tree as it is delightful when in flower.

Grevillea robusta, or Silky Oak, is also used as a street tree, and where it thrives is a suitable tree. However, a good deal of cleaning up is necessary on account of a continual fall of old leaves. Thirty feet would be a suitable spacing for this tree.

It is most necessary to stake securely all avenue trees during the first few years, or until there is no danger of their being blown over by the wind.

In laying out private avenues care should be taken to allow at least thirty feet width of road between the trees. If the trees are required to meet over the middle of the avenues, the Flamboyant or Cedrela will easily cover this distance. Instances have been seen where only a width of twenty feet or less has been allowed for the avenue, and the trees permitted to branch near the ground, making it often difficult to pass traffic on such avenues.

Should a bottom screen be required for such avenues a double line of Cypress, Callitris, or even Eucalypts, may be planted to provide a screen, but these should be planted at least fifty feet back from the avenue trees to allow them to develop properly.

Specimen trees on lawns, etc., require abundant space in which to grow naturally, and the different species should each be planted in places to suit them. Other small shrubs or rank-growing flowers must not be planted near these while small, as the shade caused may easily damage the lower branches of the specimen, and, of course, a perfect specimen depends on its branch formation for its beauty. To spoil the lower branches is to ruin the look of a specimen tree, and this is particularly so with the Cypress or Araucaria. In the case of specimen trees, like Flamboyant, which have been allowed to have clear stems, flowers may be grown around the base, but stones and soil should not be heaped around these trees, otherwise the tree will be killed in a few years.

Trees should be securely staked until strong enough to stand ordinary winds.

Propagation of Species. Most kinds of trees and some of the shrubs are easily raised from seed if ordinary care is taken.

The usual practice at the Forest Nursery is to sow seeds in half petrol tins which are ready for use when a few holes have been punched through the bottom.

Soil for the raising of seeds should consist of two parts of good ordinary soil, one part of leaf mould or road sweepings, and one part of sand. This mixed soil should be passed through a quarter inch sieve and the tins filled with it. The tins should be placed on a level surface, and the soil pressed in firmly with the hands and levelled off. The next step is to take a flat piece of wood, or even a brick, and press the surface firmly so that a smooth surface results. Everything is now ready for sowing. The seed should be sown thinly, care being taken to have an even covering of seed. The seed should be covered, barely out of sight, with a fine soil, which can be prepared from the same soil used for the tins, but put through a piece of mosquito gauze to remove all coarse stuff.

After sowing the tins must be shaded with hessian or grass and kept moist until the seeds germinate. The after-treatment is simply potting up the seedlings when large enough, using the same compost as for the seeds, shading the plants until well established, and then standing them out on a level space in full sunlight. If the plants have been raised in heavy shade it may be necessary to harden them to the sun, gradually.

The golden rule in sowing seed is to cover each species to the depth of the seed only. In the case of fine seeded Eucalyptus this is a mere sprinkling of soil only, and some omit even this.

It is very important that after the first watering the surface of the seed pans must not get dry, even for an hour. On the other hand they must not become saturated with water.

The best times of the year to raise seeds are from March to May and August to November.

Raising Plants from Cuttings. Some varieties of trees and shrubs which do not seed freely are raised by cuttings, and by cuttings is usually meant ripened wood of the previous season's growth, although young shoots are sometimes struck.

The cuttings may be from six to nine inches long and may be cut off straight at the top, but with an oblique cut below a bud at the base. At least two-thirds of the cutting should be inserted in sand, or three parts sand and one part fine soil. Cuttings may be placed fairly closely together and half a petrol tin cut depthwise will easily take one hundred cuttings.

The tins of cuttings must be moistened frequently, but care should be taken that they do not become too wet; stand the tins in a warm corner in the shade, and in a month or two the plants will be ready for potting up. Some of the cuttings may even then have no roots, but if the base of the cutting is callused it will probably root. The rooted cuttings should be firmly potted and kept in partial shade until firmly established.

A good time of the year to take cuttings is from July to September.

The mode of propagation of the various species is given in the following list:—

1. TREES.

Acacia baileyana (Bailey's Wattle). A small tree, not very long-lived in the hotter districts, but well worth growing for its beautiful foliage and yellow flowers; height about 15 feet; spreading habit; at its best along the Eastern Border of the Colony. Seeds.

Acacia cultriformis. A bushy variety, about eight feet in height, with small stiff glaucous leaves; flowers freely, and is very hardy. Seeds.

Acacia dealbata (Silver Wattle). A similar tree to *mollissima*, but with silvery green leaves; will only do well in the same districts; is inclined to become a pest at Inyanga, as seeds carried by flood water durins the rains have carried for miles and have germinated all over the place. Seeds.

Acacia melanoxylon (Blackwood). A very fine large tree, valuable for its timber; heavy dark green foliage, and insignificant pale yellow flowers; is suitable only along the Eastern Border. Seeds.

Acacia mollissima (Black Wattle). Is a fast growing tree up to 40 feet in height; dark green foliage; lemon coloured flowers. Grows to perfection only along the Eastern Border or mist belt areas and produces valuable tanning bark. Seeds.

Acacia podalyrifolia. A shrubby tree, about 10 feet high, very glaucous foliage, showy. Seeds.

Acrocarpus fraxinifolius. A medium-sized tree about 30 feet in height; deciduous, spreading crown; resembles Cedrela; is used in some countries as a shade tree for coffee, and it will probably be of use in this country for that purpose. Seeds.

Aleurites fordii (Tung Oil). This tree was first raised in Salisbury in 1923 and one or two trees six to eight years of age have grown slowly; a large deciduous tree with large maple-like leaves, and bearing a nut similar to the chestnut, from which a valuable oil is extracted. Will probably be found to thrive best in the Melsetter area. Seeds.

Aleurites montana. Simlar to *A. fordii*, and to which the same remarks apply.

Aleurites triloba (Candle Nut). A large and handsome shade tree. Seeds.

Anona reticulata (Custard Apple). A small tree, deciduous, with excellent edible fruits; seems to thrive and fruit best if the seeds are sown "*in situ.*" Seeds.

Araucaria bidwillii. Very different in habit from *A. excelsa* and *A. cookii;* it has short, stiff sharply-pointed leaves, very similar to the true monkey puzzle (*A. imbricata*).

A. bidwillii has grown well in Bulawayo; Araucarias are very hardy with the exception of *A. imbricata*, which has failed. All Araucarias raised from seeds.

Araucaria brasiliensis. A tree similar to the true Monkey Puzzle, *A. imbricata*, and a handsome specimen tree. Some have

survived in Salisbury, and a few trees are to be seen about 20 feet high; this tree, however, is inclined to die out in hot districts, but will undoubtedly do well in the Eastern Border districts.

Araucaria cookii. A similar tree to *A. excelsa.*

Araucaria cunninghamii (Moreton Bay Pine). Has glaucous foliage and is not of such formal growth as other Araucarias owing to the branches having a more tufted appearance.

Araucaria excelsa (Norfolk Island Pine). A large tree which will probably grow to a height of 100 feet; is used chiefly as a centre piece for lawns, and is a fine tree for use in large landscapes.

Bauhinia acuminata. A pure white variety similar to *B. purpurea*, and used for the same purposes. Seeds.

Bauhinia purpurea. A small showy tree 15 to 20 feet in height, with Rhododendron-like flowers, which are pinkish-mauve in colour and scented; flowers May-July, at a time of year when there are otherwise few flowers. It is used for streets and avenues, when it should be planted at 20 feet apart, and is also a very fine small tree for shrubberies. Seeds.

Bolusanthus speciosus (Rhodesia Tree Wistaria). A small indigenous umbrageous tree, 15-20 feet high, covered in Spring with panicles of intensely blue flowers similar to the Wistaria, but smaller. Seeds.

Callistemon speciosus (Bottle Brush). A small tree up to 20 feet in height with bright red flowers; the tree has a weeping habit, and is a graceful object when well grown. It makes a good hedge, but must be clipped regularly by starting near the ground, to make a thick hedge. Also in use for avenues, where it should be planted at 20-25 feet apart. Hardy. Several other varieties have all been grown with success from seeds.

Callitris calcarata (Black Cypress Pine). A small tree to about 40 feet, excellent for grouping effects; a useful species for timber or landscape and used also for hedges. Seeds.

Callitris glauca. Very similar to *C. robusta;* good in the hot districts but not on diorite. Hardy. Seeds.

Callitris rhomboidea. Has been used as hedges only. Seeds.

Callitris robusta (White Cypress Pine). Growing to 30-40 feet high; is a very good timber and ornamental tree, has glaucous foliage. Hardy. Seeds.

Callodendron capensis (Cape Chestnut). Discovered to be indigenous to this Colony. It is a fine flowering tree, with white spotted purple flowers, but is rather slow in cultivation. Seeds.

Carica papaya (Paw Paw). A large herbaceous plant up to 15 feet in height, and bearing a well-known fruit; a short-lived plant; and requires renewing every 3 or 4 years for the best results. Tender to frost. Seeds.

Casimiroa edulis (Mexican Apple). An extremely fast-growing large evergreen tree, height 30-40 feet, dense foliage, weeping habit, and with an edible fruit rather larger than a golf ball. Seeds.

Cassia alata. A shrubby tree, large leaves, yellow flowers. Seeds.

Cassia javanica. The pink Cassia, a large shrubby tree, raised from seed with considerable difficulty locally. Seeds.

Cassia siamea. A small evergreen tree, about 25 feet in height, with bright green shining leaves, and heads of pale yellow flowers. It is very tender to cold when young and must be protected. Seeds.

Cassia sp. A very fine small tree, yellow flowers about February-March, practically evergreen. We received this tree from South America under the name of Caruda da Pito. Seeds.

Castanospermum Australe (Australian Chestnut). A fine shade tree resembling Cedrela, but with bright shiny foliage, bearing orange-red flowers produced close to the stems, in early Spring. Hardy. The best results will probably be obtained by sowing *in situ*. Seeds.

Casuarina cunninghamiana (Beefwood). A very hardy tree and will thrive in most unlikely places. Seeds.

Cedrela odorata. A similar tree to the toon, but not so hardy in the young stages, requiring protection for the first winter; both by seeds.

Cedrela toona (The Toon). A large shade and timber tree introduced in 1910; thrives to perfection in the heavy soils, and is used most extensively for street work, where it is planted 20 feet apart; the timber is an excellent cabinet wood. Very hardy.

Ceratonia siliqua (*Carob Bean*). Has been grown in the Umtali district and tried elsewhere; a small evergreen tree, 20-30 feet in height, bearing the beans known as locust beans, an excellent stock feed; trees are a little difficult to establish. Seeds.

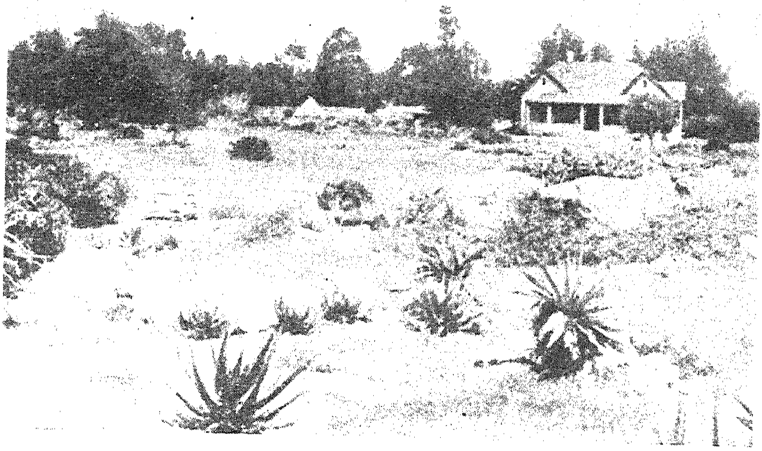
Croton sylvaticus (Mount Selinda Linden). An indigenous tree from the Eastern Border, broad-leaved, deciduous; a good shade tree up to 30 feet in height. Seeds.

Cryptomeria elegans. A smaller tree than *C. japonica*, but also a very valuable tree on the Eastern Border; foliage turns a beautiful fiery red in Autumn; for the wet districts only. Seeds.

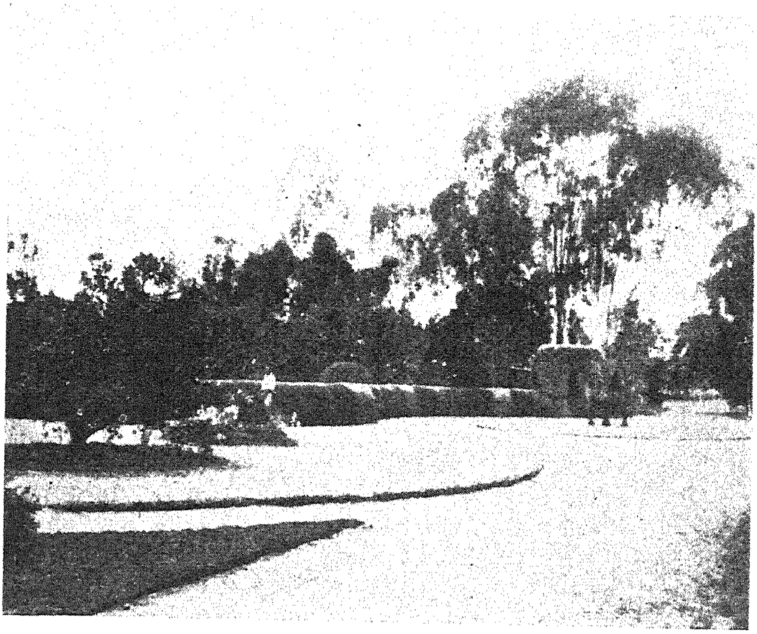
Cryptomeria japonica (Japanese Cedar). A coniferous timber tree, which has grown to over 40 feet in height; a handsome specimen tree; will become a valuable tree on the Eastern Border, but most other districts are too dry for it. Seeds.

Cupressus arizonica (Arizona Cypress). A very hardy Cypress suited to the hot districts; a good hedge variety.

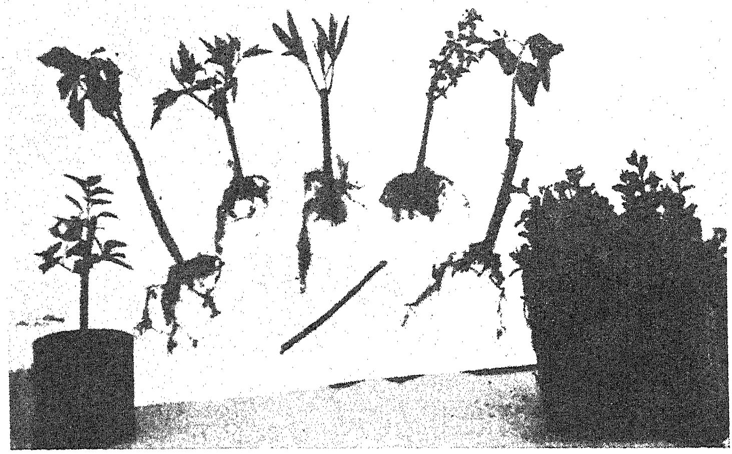
Cupressus funebris. A hardy small tree for the warm districts; slow in growth.



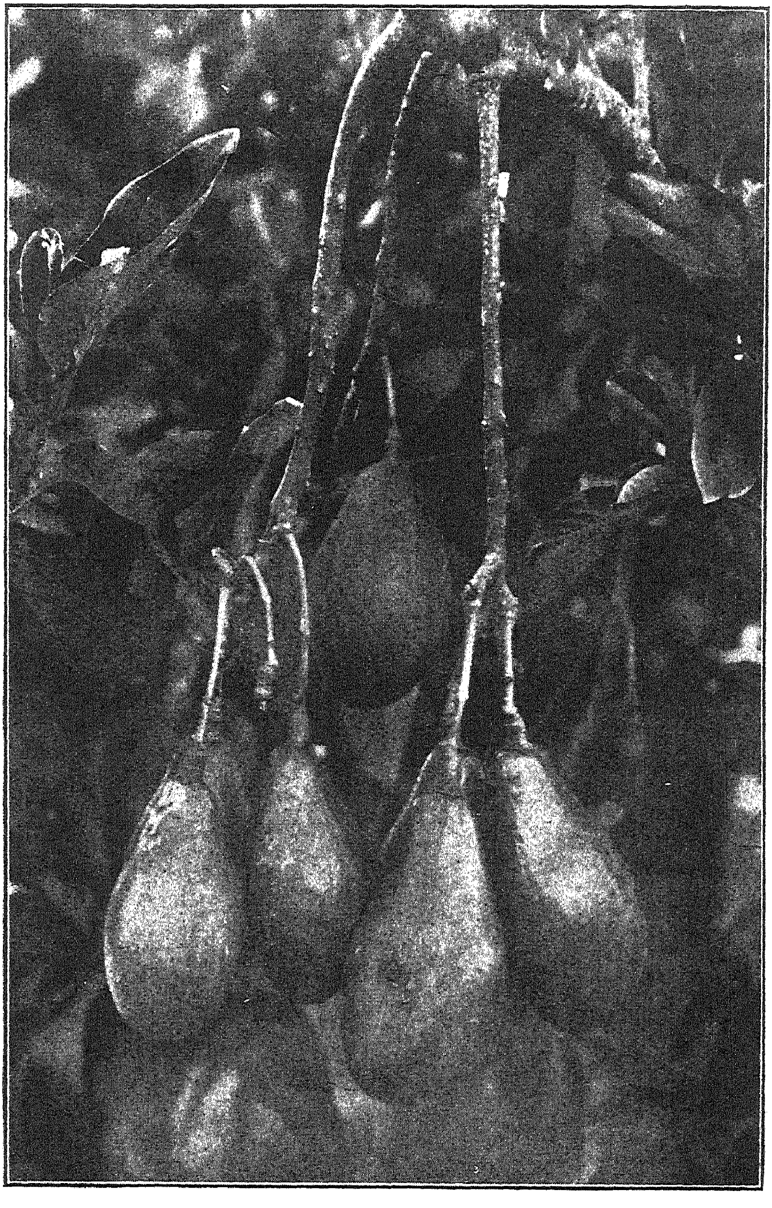
A landscape scene at Munda we Gwenzi ("Garden of flowering trees"), the residence of Sir Ernest Montagu, Salisbury, showing a section of the rock garden and lawns, supported by well arranged backgrounds of trees and shrubs. An excellent object lesson in making the most of the natural lie of the land.



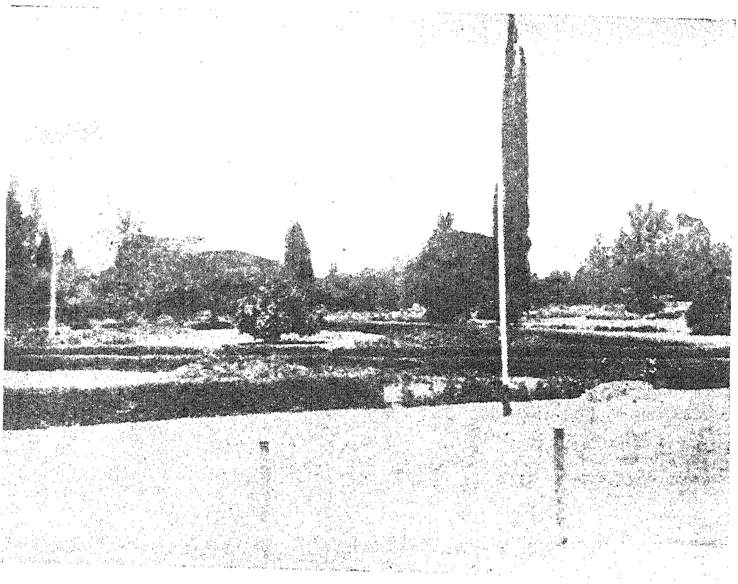
A scene in the garden of the residence of Mr. A. Lockie, Mount Pleasant, Salisbury. This garden was laid out by our former Chief Forest Officer, Dr. Henkel, and is an excellent example of landscape work. The hedge is of *Cupressus arizonica*, and has been well kept.



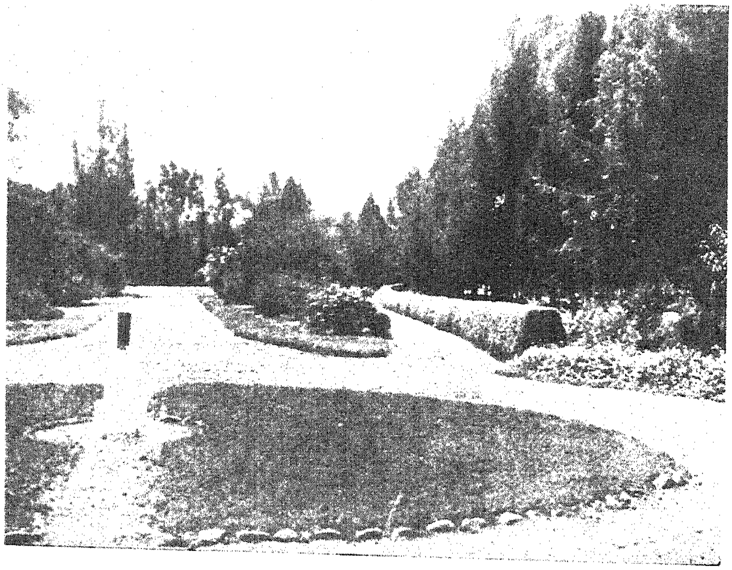
Cutting of various flowering shrubs properly rooted. Tin of cuttings on right about ready for potting up; at this stage they will have very little root and should be potted up several in a tin and planted deeply. On left, after properly rooted, potted into separate tins and just above the good root system.



Persea gratissima (Avocado Pear). A photograph taken in 1923 at the residence of Mr. Justice McIlwaine, Orange Grove, Salisbury. These were probably the first trees to bear fruit in the Colony.



A landscape scene in the Public Gardens, Salisbury. On left *Schizolobium excelsum*; on right *Cupressus sempervirens-pyramidalis.*



GOVERNMENT FOREST NURSERY, SALISBURY.

A scene at the nursery, showing on right a hedge of bottle brush (*Callistemon speciosus*), properly built up and thick. This hedge was made from a line of trees eight feet high, and was cut near the ground to make the trees branch out; the cypress trees on the right are too close to the hedge for the best results.

Eucalyptus maculata (Spotted Gum). Fine trees growing in the Public Gardens, Umtali.

Avenue Trees. Showing correct method of growing avenue trees. Grown two seasons to obtain a tall, strong, single stem, now ready to cut back to form a crown. This will be cut off at mark seven feet from ground, and four to six shoots allowed to develop from the top foot of stump.

(The above photograph was taken when this tree was two years old. In May, 1944, when eleven years old, it had a breast height diameter of 20 inches, clean bole to 7 feet, total height of 48 feet and crown diameter of 42 feet.)

Cupressus lawsoniana. A very handsome variety; for the wet districts.

Cupressus lusitanica (Portuguese Cypress). It is the most successful species of Cypress in the heaviest rainfall areas, growing almost like a weed on the Eastern Border; it is inclined to die out during the dry winters in the warmer districts.

Cupressus sempervirens horizontalis. A variety which does well and is very hardy.

Cupressus sempervirens pyramidalis (Chimney Cypress). A tall Italian Cypress; very successful in Mashonaland.

Cupressus torulosa (Himalayan Cypress). A most successful tree in Mashonaland, and also doing well in the driest parts of Matabeleland; this handsome tree is widely used for timber and ornament.

All the above Cypresses are raised from seeds.

Dais cotinifolia. A small tree producing small heads of lilac-like flowers; has grown to 10 feet high. Difficult to propagate.

Datura arborea (Potato Tree). A large shrubby tree, very fast grower, height to 30 feet, flowers profusely, large bluish-purple. Tender in the young stage, leaves have strong thorns when young, but these disappear from the leaves as the tree gets older. Has large apple-like fruits which are probably poisonous. Seeds.

Duabanga sonneratoides. A fine tree, with very large evergreen leaves; would undoubtedly make a very fine avenue. Seeds.

Duranta plumieri (Tree Forget-me-not). Growing to about 15 feet high; there are several kinds growing well, some are very thorny, others without thorns; all have flowers practically the same in colour—blue. Also a white variety. Cuttings.

Eriobotrya japonica or *Photinia japonica* (Loquat). The well known shrubby tree, producing yellow edible fruits in the Autumn. Seeds.

Erythrina caffra (Kaffir Boom). A well known large indigenous tree with coral red flowers. Easily raised from seeds, or truncheons.

Erythrina crista-galli. A small variety, about 4 feet high, usually sending out new growth each year from the base; has terminal spikes of red flowers. Seeds.

Eucalyptus Species. The following species have been tried, and the district in which they have done best is stated.

E. amygdalina (Peppermint Gum). Eastern Border. At Inyanga a good tree, tender to frosts while small.

E. botryoides. Has grown well in Mashonaland on deep soils, and on Eastern Border.

E. calophylla. Eastern Border, a good ornamental tree, about 20 feet in height.

E. citriodora (Lemon-Scented Gum). Poor on Eastern Border, excellent in parts of Mashonaland. Sometimes tender to frost while small

E. coriacea. Has thrived on the Eastern Border, but not a good tree.

E. cornuta. A small tree. Only on Eastern Border.

E. creba. Fails in wet districts, fair in Salisbury, fairly good at Bulawayo.

E. diversicolor (Karri). A few planted at Inyanga justify further planting there.

E. ficifolia (Red-Flowered Gum). Good on Eastern Border, but cannot be considered a successful tree away from the wet districts.

E. globulus (Blue Gum). Grown to perfection on Eastern Border, and wet areas; was also grown there successfully from seed sown *in situ*, 2 lbs. per acre; in five years, poles 45 feet feet in length were being cut out from these sowings.

E. hemiphloia (Grey Box). Fair in the hotter districts.

E. longifolia (Wooly Butt). Fair in Salisbury, probably do well on Eastern Border.

E. maculata (Spotted Gum). Very fine trees at Umtali, fair tree in Salisbury, poor on Eastern Border mountain , yet excellent at Umtali where the altitude is much lower.

E. maideni (Maidens Gum). Is doing well in the Midlands.

E. melliodora (Yellow Box). A poor tree in Salisbury, better in Matabeleland.

E. microcorys (Tallow Wood). Grown to perfection on Eastern Border; a small tree in Salisbury.

E. paniculata (Ironbark). Grows well on Eastern Border, but is easily damaged by strong winds, does fairly well in the hotter districts; a good avenue tree.

E. pilularis (Black Butt). A very fine tree on Eastern Border, and is a fair tree in Salisbury; tender to frost when small.

E. polyanthema (Red Box). Would make a good avenue tree in the warmer districts.

E. punctata (Leather Jacket). Doing well on Eastern Border.

E. resinifera (Red Mahogany). A very fine tree on Eastern Border, or wet districts, but not so good elsewhere; a large flowered type of this, *E. hemilampra*, has done remarkably well at Inyanga, where it has reached 70 feet in height in about 15 years.

E. robusta (Swamp Mahogany). Doing well on Eastern Border, but only a small straggling tree in warmer districts.

E. rostrata (Red Gum). One of the hardiest and best trees for the hot districts, doing well nearly anywhere if the soil suits it, but fails on Eastern Border.

E. saligna. A very fine tree where there is a fair rainfall and deep soil, one of the best on Eastern Border; this tree has become mixed up with *E. grandis*, and most of the trees grown in Rhodesia are of the latter species; both do well in the wet districts.

E. siderophloia. A success on the Eastern Border.

E. sideroxylon (Red Ironbark). A fairly good tree in the warm districts.

E. stuartiana. A good tree at Inyanga.

E. tereticornis (Forest Red Gum). Shares with *E. rostrata* pride of place as the hardiest gum for general planting, but of no use in the mountain areas.

E. viminalis (Manna Gum). Has done fairly well on sand veld around Salisbury. All the Eucalypts are raised from seed.

Ficus capensis. An indigenous fig, growing into a large evergreen tree. Seeds or cuttings.

Ficus cotinus. An evergreen tree received from Mexico; dense foliage, good shape, strong grower, will make a good shade tree. Seeds or cuttings.

Ficus macrophylla. This is a fine evergreen fig, making a large shade tree, and thrives on very poor soil; will grow to 25-30 feet in height, and is inclined to branch close to the ground, but if pruned up can be made into a first-class specimen. Hardy in hot districts. Seeds.

Ficus religiosa (Peepul Tree). A large handsome tree, very tender to frosts while small. Seeds.

Ficus retusa. A large spreading tree; evergreen with small shining leaves; very hardy; thrives at Bulawayo on practically pure sand. Large surface roots are rather a drawback. Cuttings or layers.

Grevillea caleyi. A small tree, or shrub; evergreen; height about 8 feet; has red flowers. Seeds.

Grevillea robusta (Silky Oak). A medium sized tree; evergreen; not very successful in Mashonaland where it is inclined to die back, but is used as a street tree in Matabeleland; is also used as a shade tree for coffee. Seeds.

Hovenia dulcis. A small tree; has grown fairly well, but seems to have nothing to recommend it.

Hymenosporum flavum. A medium sized flowering tree, about 20 feet with rather scanty foliage and bearing trusses of large whitish-yellow scented flowers in Spring. Seeds.

Jacaranda mimosaefolia. Too well known to need description as it is grown by nearly everyone; used extensively for street work, and during the flowering period, September-November, the

town of Salisbury is a blaze of lavender coloured flowers. This tree is tender to frosts and should be protected until it has reached a height of 5 feet. Seeds.

Jatropha curcas (Purging Nut). Has grown to 9 feet in height in three years, with a spread of 7 feet, and this year has produced 5 lbs. of seed. Is probably of economic value; tender to heavy frosts. Seeds.

Juniperus procera (Kenya Cedar). A valuable timber tree from Kenya Colony, but is probably only useful in the warmer districts here for the shrubbery; has reached a height of 6 feet in four years. Should do well on Eastern Border. Seeds.

Juniperus virginiana. Useful small tree with valuable timber; a very suitable conifer for the shrubbery in all districts.

Also *Juniperus bermudiana.* Seeds.

Khaya nyasica (Banket Mahogany). The largest indigenous tree in the Colony, and producing a valuable timber; only to be grown as large timber where there is plenty of moisture; has reached a height of 30 feet in 15 years at Salisbury. Seeds.

Lagerstraemia regina. A small shrubby tree with much larger leaves and flowers than *L. indica;* of a mauve colour; hardy. The leaves have fine Autumn effects before falling. Cuttings.

Lagunaria patersonii. An evergreen tree 25-35 feet in height, producing pretty pink flowers; not very successful in Mashonaland, but does well in Matabeleland, where it is used as a street tree in Bulawayo. It is rather dangerous for children, as the numerous seed capsules contain countless small irritating hairs. Seeds.

Macadamia ternifolia (Queensland Nut). A nice evergreen small tree producing an edible nut of good flavour, although the shells of the nuts are very hard.

Also *Macadamia integrifolia.* Both by seeds.

Magnolia grandiflora. A small tree up to 20 feet in height; slow grower; produces single white flowers in summer; flowers up to one foot across are common. Seeds, but difficult to germinate.

Mangifera indica (The Mango Tree). The mango is a hardy tree in Mashonaland, but is inclined to be damaged by frosts; fruits readily, and some fairly good fruits are always available during summer. Seeds.

Melia azedarach (Syringa). A rather large deciduous tree, somewhat like Cedrela; was used extensively at one time for street and garden trees; pretty sweetly scented flowers of a lilac colour, in large panicles; its timber is excellent. Seeds.

Michelia champaca. A small evergreen tree, producing sweetly scented golden yellow flowers; inclined to die out in a few years, and probably needs a wetter district than Salisbury. Seeds.

Morus sp. (Mulberry). Several species are grown and thrive like weeds. A large fruited variety introduced many years ago by the late Sir Robert McIlwaine grows to perfection and is well worth growing for its large fruits. Cuttings.

Parkinsonia aculeata (Jerusalem Thorn). A small thorny tree with light foliage growing to a height of 15-20 feet; flowers yellow, it is a pretty sight when in flower; also makes a good specimen. Seeds.

Peltophorum africanum (Rhodesian Wattle). An indigenous tree which seems to be coming into its own for street work. They are reasonably fast growers which is the great drawback to most of our trees. Seeds.

Persea gratissima (Avocado Pear.) The Avocado Pear is now fairly well known, and is found to grow fairly well in most parts of Mashonaland, but not in the coldest areas; fruits well, but the tree only just grows successfully here, as shown by the fact that branches are usually found to be dying back on the trees after they are a few years old. Most of the older trees were raised by seeds, but during the past few years budded trees have been imported.

Phytolaca dioica (Belhambra). A rapidly growing tree up to 40 feet in height, with large soft branches and dense foliage; large surface roots are a drawback and are dangerous near buildings. The tree is used in Australia as a cattle fodder in times of drought. Seeds.

Pinus canariensis (Canary Island Pine). Is hardy to most parts of the Colony, slower in growth than some of the other pines; it is making a good tree in Mashonaland. Seeds.

Pinus cembroides (Mexican Nut Pine). A small beautiful tree very suitable for gardens, but thrives only on the Eastern Border. Seeds.

Pinus halepensis (Aleppo Pine). A very hardy pine, doing fairly well in Matabeleland; is sometimes used as a hedge in Mashonaland. Seeds.

Pinus longifolia (Chir Pine). Another good hardy tree growing well in most parts of the Colony. Seeds.

Pinus muricata (Bishop's Pine). Will grow into a timber tree on the Eastern Border. Seeds.

Pinus patula (Spreading-Leaved Pine). Introduced in 1920; this handsome pine competes with *P. radiata* in rate of growth at Inyanga, on the Eastern Border, and will no doubt be of the greatest value to the Colony as a first-class timber tree. Seeds.

Pinus pinaster (Maritime or Cluster Pine). Growing well on the Eastern Border, though much slower than *P. radiata.* Seeds.

Pinus radiata (Monterey or Remarkable Pine). Up till recently called *Pinus insignis;* this tree has been a great success on the Eastern Border, in the Inyanga and similar districts,

and is of first-class importance as a timber tree for this Colony in that district. Three or four trees planted about twenty years ago at Sir Ernest Montagu's residence at Borrowdale, Salisbury, on a contact soil, have done very well, and it seems that the tree will do best in contact or granite soils, and dies out badly in diorite soils. It should be planted with caution in areas under 30 inch rainfall. Recently this tree has been severely attacked by *Diploidea pinea* and it is advised that the Forest Department be consulted when new plantations are contemplated. Seeds.

Pinus taeda (Loblolly Pine). Another variety successful on the Eastern Border. Seeds.

Poinciana regia (Flamboyant). A large flat-topped spreading tree, usually about 20-30 feet high, covered in Spring with bright scarlet flowers; is an excellent street tree, but large surface roots are rather troublesome. Trees of this variety were planted in the main street at Umtali many years ago and are famous for the wonderful show they make; unfortunately many of these trees have been removed during recent years, which has rather spoilt the effect. Seeds.

Populus alba (White Poplar). This tree is useful along stream banks and other moist well-drained places. It is a mistake to think that they can be planted in wet sour vleis and expected to grow successfully; if the ground cannot be ploughed and sweetened, raised mounds should be thrown up and allowed to weather, forked over in the Spring, and the suckers then planted; after being successfully established they will soon run into the wet surroundings and send out more suckers. Suckers.

Populus deltoidea var. *Missouriensis* (Carolina Poplar). A variety introduced in 1921, and has grown well. Of the original cuttings put in at Salisbury in September, 1921, three of the rooted trees were left in and the balance moved to other quarters; the largest of the three trees left is to-day 78 feet high and 25 inches diameter, breast high; this variety seldom sends up suckers. Cuttings.

Psidium pomiferum (Guava). A small hardy evergreen tree bearing a well known fruit, pink-fleshed; there is also a white-fleshed kind. Seeds.

Quercus ilex (Holly Oak). Has grown slowly in Salisbury and reached a height of 13 feet in 15 years. Seeds.

Quercus pedunculata (Common Oak). Trees of this type have reached a height of 50 feet on the Eastern Border, but it is a waste of time to plant it elsewhere. Seeds.

Rhus lancea (Karee Boom). An indigenous small shrubby tree, evergreen and excellent as a rough hedge screen; quick grower. Seeds.

Rhus succedanea (Red Lac Sumach or Japanese Wax Tree). A small shrubby tree; has so far reached a height of 10 feet; has large dark green pinnate leaves, turning to a fiery red in Autumn before falling. Seeds.

Rhus vernicifera (Chinese Lac Tree). A small evergreen tree up to 20 feet high; has heavy bright green foliage; has thrived, but is tender to frosts the first year or two. Seeds.

Salix babylonica (Weeping Willow). A rather large tree up to 30-40 feet high, in a favourable spot; a valuable timber tree and is useful for stock feed; its long drooping branches are very effective, especially when growing along river banks. Cuttings.

Schinus molle (Pepper Tree). A well known evergreen tree, up to 25 feet high; well grown specimens are handsome shade trees; good specimens are to be seen in the Bulawayo area. Seeds.

Schinus terebinthifolius. A small to large spreading evergreen tree, which is covered in Spring with small red berries. Seeds.

Schizolobium excelsum. An extremely rapidly growing tree having large pinnate leaves and large sprays of yellow flowers in Spring; has grown to a height of 40 feet in five years in Salisbury Gardens. Seeds.

Securidaca longipedunculata (Rhodesian Violet Tree). A small deciduous indigenous shrubby tree with small leaves, bearing early in Spring masses of small reddish flowers scented like violets. Is raised from seeds, which are very difficult some years; is very slow growing, and usually dies when transplanted. Probably the only successful way to grow this is by sowing *in situ*, and when a year or two old to plant other plants near to draw it up more quickly.

Spathodea campanulata (African Flame Tree). A handsome large-leaved tree to 25 feet in height with large red flowers edged with gold; valuable as a street tree, when it should be planted at least 25 feet apart; tender to frosts while small; requires deep well drained soil; flowers in April-June; deciduous. Seeds.

Sterculia acerifolia (Australian Flame Tree). This is a beautiful tree, with large bright green leaves, and in Spring has crimson flowers; grows to 20 feet in height; the tree is not really a success as it is inclined to die out after a few years. Seeds.

Sterculia diversifolia. A small evergreen tree growing only to about 15 feet in 20 years at Salisbury; is a valuable tree and used in Australia as a stock food. Seeds.

Sterculia sp. This variety is probably *S. discolor;* is a handsome flowering tree, and some fair specimens are to be seen in the streets of Salisbury, but like *S. acerifolia* it is doubtful if this species will live long. Seeds.

Thuja orientalis (Thuja). A hardy conifer used as a hedge or small tree; height about 20 feet. It is not very satisfactory as a hedge, as odd plants have a habit of dying out for no apparent reason. Seeds.

Tipuana speciosa (Tipu Tree). A smallish tree with floppy branches unless pruned, when it makes quite a good tree; yellow flowers. Seeds.

Trichelia emetica. A large evergreen tree, with large dark green leaves; rather slow in growth but making a fine shade tree; tender to frosts whilst small. Seeds.

Widdringtonia whytei (Mlanje Cedar). An indigenous coniferous tree, growing in the mountains of the Eastern Border, usually about 25 feet in height, and about 6 inches diameter; the tree thrives best where water is seeping around its roots; produces a fine and valuable timber, some of which is used in hut roofs at Inyanga and is as good after 25 years as the day it was cut. This conifer will coppice freely after the trees are felled. Seeds.

2. SHRUBS.

Abelia floribunda. A hardy shrub up to six feet high, with shining myrtle-like leaves; flowers small pinkish white bell-shaped and produced in profusion in Spring; evergreen when watered during the dry season; is not recommended as a hedge. Hardy. Propagated by cuttings.

Aberia caffra (Kei Apple). A thorny slow-growing shrub, formerly used for cattle proof hedges; foliage dark green and fruits yellow, being similar in size and colour to apricots; these are edible, and used for preserves. Seeds.

Abutilon sp. (Chinese Lantern). A well-known shrub with lantern-like flowers variously coloured; will grow to height of 8-10 feet, but is best kept to about five feet by pruning yearly; is not a long-lived shrub, usually dying out in about four years. Will not stand heavy frost. A variegated foliage variety is very handsome. Seeds or cuttings.

Acalypha hamiltonii. A handsome compact variety, with glossy red-green leaves. Cuttings.

Acalypha macrophylla. With large blotched leaves about 9 inches x 6 inches in size when well grown; a very handsome variety, showing up well in a dark green background. Cuttings.

Acalypha marginata. Grown for its ornamental foliage, which is red-green with the margins of the leaves red; height 8 feet; grows best in a partially shaded situation, and should be protected during frost. Cuttings.

Acokanthera venenata (Poison Bush). A South African shrub, about 8 feet in height with dark green leaves; branches covered with axilliary, pinkish white flowers; purple plum-like small fruits.

All authorities state that this shrub is very poisonous, and therefore not recommended.

Adenium multiflorum. Found growing in Rhodesia below the 2,000 feet altitude; very showy, red and white flowers in clusters, very slow growing, and with an enormous root. Probably poisonous. Seeds, but best by digging out the bushes and transplanting as seeds very slow.

Adhatoda duvernoia (Pistol Bush). An evergreen shrub, 6 to 10 feet in height, tender to frost, and with pinkish-white flowers. Cuttings.

Allamanda neriifolia. A shiny leaved shrub, 3 to 6 feet high, with bell-shaped yellow flowers. Evergreen. Seeds or cuttings.

Allamanda violacea. A very fine violet-purple variety of rather small size, being about 4 feet high, best treated as a shrub, any long shoots being tied in, or cut back. Cuttings. Propagation difficult.

Althaea sp. A small shrub up to 6 feet high, allied to Hibiscus; several varieties, some with single flowers, light purple and white, others with double flowers; found to do best in partial shade. Hardy. Deciduous. Cuttings.

Aloysia citriodora (Lemon Scented Verbena). A small bush usually about 4 to 6 feet; flowers insignificant, white; grown for its cented foliage. Deciduous. Cuttings.

Alstonia scholaris. A small shrub about 6 feet in height; resembling oleander, with bunches of pure white flowers, evergreen. Seeds.

Bauhinia galpini (Pride of the Cape). Should be called Pride of Rhodesia, as it occurs abundantly in portions of the Colony. There are several indigenous Bauhinias.

This is a rambling, climbing shrub and loves to climb over other trees, where it will reach a height of 30 feet; flowers are terra-cotta coloured and shaped like nasturtiums; when in bloom is very effective. Hardy. Seeds.

Berberis darwinii. A small berry bush, very thorny, showy berries, has done fairly well, but would do well in the wetter districts.

Also *Berberis Thunbergiana.* Both by seeds.

Bixa orellana (Annotto). A dark green shrub, 6-8 feet in height with rather pretty pink flowers; dense foliage; evergreen. A dye is obtained from this which is used in colouring cheese. Seeds.

Bontia daphnoides. An evergreen shrub, leaves similar to Oleander but smaller, and of a bright green, flowers insignificant. Seeds.

Brugmansia knightii (Moonflowers). Makes a fine shrub 10-15 feet high. It has large single highly-scented flowers during summer. It requires protection in winter while small, as heavy frosts cuts it back. A double variety is also grown, but not so strong in growth, height 6 feet. Seeds or cuttings.

Brunfelsia americana. A small bush up to 6 feet in height. A variety with whitish-yellow flowers, over an inch in diameter; flowers in early Spring. Cuttings.

Brunfelsia eximia (Yesterday-To-day-To-morrow). The uncommon name of this plant is owing to the fact that the flowers turn a different colour daily. They are at first a fine violet-purple. A small slow bush, up to about 6 feet in height, but a beautiful sight in early Spring when covered with flowers which are also scented. Seeds or suckers.

Buddleia sp. Several varieties of Buddleias are grown, and thrive, some with blue to purple flowers; flower in the Spring, and grow up to 10 feet in height.

An orange-flowered species grows rankly to a height of 15 feet and flowers in June-July. Flowers sweetly scented.

An indigenous variety, *B. salviaefolia*, flowers in May-July, and has pinkish-purple scented flowers, and is a common shrub on the Eastern Border. Seeds or cuttings.

Calpurnia aurea. A small shrub about 6 feet high, with laburnam-like yellow flowers. Seeds.

Caesalpinia sepiara (*Mauritius Thorn*). An extremely strong-growing thorny shrubby half climber, mimosa-like leaves, and very handsome heads of yellow-red flowers. It makes excellent cattle proof fences and requires plenty of room. Seeds.

Carissa grandiflora (Amatungula). Thorny bush with dark shining foliage, deciduous here unless watered, bears small purple plums which are edible. Seeds. Other species are indigenous to the Colony.

Cassia capensis (Cape laburnam). A showy yellow-flowered shrub which flowers profusely in the Autumn; about 6-8 feet high. Hardy. Seeds.

Cassia splendida. A rambling shrub with bright yellow flowers, very showy. Seeds.

Citharexyllum berlandieri. Similar to above but smaller leaves, small white flowers, followed by red berries. Cuttings or seeds.

Citharexyllum sp. Large shrubby tree, grown locally for its lovely Autumn tinted leaves.

This is the shrub previously listed as Zytheryllum, but the above is the correct name. Cuttings.

Ceratostigma willmottiaeanii. A beautiful small shrub similar to Plumbago, but the flowers are of a deeper blue. Seeds.

Cestrum aurantiacum (Ink Berry). A large shrub up to 10 feet high, with orange yellow tubular flowers. Cuttings.

Cestrum elegans and other kinds also do well. Cuttings.

Clerodendron fallax. A small shrub about three feet in height; a wonderful show with its scarlet flowers. Cuttings or seeds.

Clerodendron Ugandaensis. A smallish shrub with pretty blue flowers. Seeds or cuttings.

Cotoneaster buxifolia. A small spreading shrub, slow growing, red berries in April; stands drought well. Seeds.

Crataegus coccinea (Hawthorn). Growing to about 6-8 feet, is a showy shrub when in berry. Deciduous, white flowers, berries golden red. Seeds.

Crotalaria juncea. This well known plant is the Sunnhemp, and is used extensively for green manuring; all Crotalarias propagated by seeds.

Crotalaria laburnifolia. A shrub 6 to 8 feet in height, greenish yellow flowers in racemes, the flowers resembling small birds. Seeds.

Crotalaria sp. Some are fair-sized shrubs, and others small plants with yellow flowers; several species are indigenous to the Colony.

Cydonia japonica (Flowering Quince). A deciduous small shrub about 4 feet; flowers appear very early in Spring, about August, before the leaves, and are red in colour; useful for cutting. Cuttings.

Cyphomandra betacea (Tree Tomato). A large shrubby herbaceous plant, about 6-8 feet in height, bearing edible fruits; plants must be renewed every few years; tender to frost. Seeds.

Deutzia crenata (Bridal Wreath). A small growing bush here, about 5 feet, with masses of double white flowers, tinged with pink. Cuttings.

Deutzia vilmoriana. Similar, but with single white flowers. Cuttings or seeds.

Dodonaea viscosa. An indigenous shrub from the Eastern Border; has bright green narrow leaves, and will make an excellent hedge, but dies out after a few years in Mashonaland, but curiously enough it is about the best long-lived hedge in Bulawayo, where one would think it would not do at all. Seeds.

Dombeya sp. Two varieties do well; one, a large shrub, has pale pink paper-like flowers; the other, a small shrub with deep rosy-pink flowers. Cuttings.

Duranta repens. A variety of the well-known shrub forget-me-not, but with smaller leaves, and many more thorns; it also has more berries than the one usually grown. Seeds and cuttings.

Eranthemum sp. A shrubby herbaceous plant with deep blue flowers; likes shade and plenty of water. Cuttings.

Eugenia braziliensis (Brazilian Cherry). A small shrub useful for its fruit, which is made into a jelly; has been used as a hedge plant, but unsuitable as it is deciduous; excellent for game. Seeds.

Eupatorium multicifolia. A small shrub, about 3 feet; sprays of small white flowers; useful for cutting. Seeds or cuttings.

Euphorbia fulgens or *jacquiniaeflora.* A beautiful variety, growing best on the sand veld; attains to about 6 feet high; has small star-shaped orange-scarlet flowers. Cuttings.

Euphorbia splendens (Christ Thorn). A useful small thorny bush, 18 inches in height, usually covered with bright red flowers; is a useful and showy edging to small borders, or in the shrubbery. Also a large-leaved variety. Cuttings.

Exochorda grandiflora. A shrub, has reached 6 feet so far, producing large pure white flowers, similar to mock orange, in early Spring and before the leaves appear. Seeds or cuttings.

Freylinea tropica. A small indigenous shrub from the Eastern Border, about 6-8 feet in height, has small plumbago-like flowers; evergreen where it can obtain water; makes an excellent close hedge, but must be watered during the dry season. Seeds or cuttings.

Galphimia gracilis. A small shrub, with yellow flowers; has been used as a small hedge. Seeds or cuttings.

Gardenia florida. Heavy glossy foliage, and highly scented double white flowers; this is a good shrub, but likes plenty of water. Cuttings.

Hamelia patens. A fair sized shrub evergreen where it can be watered; dark green foliage; orange-yellow flowers, followed by small blue berries. Cuttings.

Heliotrope sp. Small garden shrubs; good varieties may be raised from seeds; vary in colour and size; sweetly scented flowers of a lavender colour. Seeds or cuttings.

Hibiscus mutabilis. A hardy shrub growing to 10 feet high, inclined to straggle; has large single pink flowers, similar to the single hollyhock. Seeds or cuttings.

Several varieties of Hibiscus occur in this Colony, including *Hibiscus cannabinus*, which is a valuable fibre plant, and is to be found in most parts of the Colony, growing in places to 10 feet in height. Seeds.

Hibiscus rosa-sinensis. This Hibiscus is too well known to need description; is used as hedges and as large shrubs. Several colours are in cultivation here, some with single, and others with double flowers. Cuttings.

Holmskioldia sanguinea. A strong grower, to 10 feet in height, producing red papery flowers on long spikes, in March-June; very valuable as cut flowers. Cuttings.

Holmskioldia sp. A yellow-flowered variety exactly similar to *Holsmskioldia sanguinea.* Cuttings.

Hydrangea japonica. Small shrubs up to 4-6 feet in height; doing well in sheltered situations, and when well watered; also suitable as a verandah shrub in tubs. Cuttings.

Hypericum lanceolatum (St. John's Wort). A shrub indigenous to the Colony, rather large, deciduous away from the Eastern Border; has attractive orange yellow flowers, and flowers profusely. Cuttings or seeds.

Hypericum quartinianum. Another variety indigenous to the country, with flowers similar to *H. lanceolatum;* smaller than the former in growth. Cuttings or seeds.

Iboza riparia or *Moschosma sp.* (Rhodesian Spirea). A medium sized indigenous shrub; has aromatic leaves and large

spikes of small blue flowers, flowering during the winter months; deciduous. Cuttings.

Iochroma tubulosa. Of the Solanaceae family; this is a shrub about 10 feet in height, and has deep blue tubular flowers about an inch and a half long; showy. A scarlet variety is very effective. Cuttings.

Ipomea arborea. Also from Mexico; a tree form of morning glory covered in April-May with thousands of large white flowers, very effective display, grows to 12-15 feet in height, spreading branches. Seeds.

Jasminum primulinum. A yellow flowered climbing shrub which is rather untidy unless kept tied in and trimmed. Hardy. Cuttings.

Jasminum sambac. A strong and hardy evergreen semi-rambling shrub, with clusters of large white flowers. Cuttings.

Jatropha coccinea. A handsome shrub, producing scarlet flowers and pretty foliage; is tender to frosts; the fruits are probably poisonous. Seeds.

Kerria japonica. A small shrub about 4 feet with pretty orange-yellow double flowers; flowers in summer. Cuttings.

Lagerstraemia indica (Pride of India). Also called the Crepe Flower; there are white, pink and mauve varieties; leaves turn red before falling. They are rather large shrubs, reaching a height of 15 feet; the best heads of flowers are obtained by annual pruning; very hardy. Cuttings.

Lantana sp. (Cherry Pie). A straggling shrub; the common colour of the flower is orange and red; grows like a weed; has been used as hedges, but is not now recommended, as the seeds are carried by birds and the shrub germinates everywhere, and is liable to become a serious pest. A white variety grown does not seed freely, so is safe to plant, and is worth growing. Cuttings.

Lasiandra macrantha or *Pleroma macranthum.* A small shrub 6 feet high; evergreen; has beautiful large purple flowers, the bush is easily damaged by high winds, and is inclined to die out after a few years. Cuttings.

Leucaena glauca. A small bush growing to 6 feet high and bearing small whitish flowers; this shrub was introduced for trial as a stock feed, for which it may be of some value. Seeds.

Ligustrum lucidum (Chinese Privet). A very good species for hedges, especially in heavy vlei soils, or where it is rather wet; to make a dense hedge it must be cut back regularly from near the ground up, or it will be too thin later on. Seeds.

Muehlenbechia platyclada. Is a small shrubby herbaceous plant up to 6 feet high, with curious flat branches; small insignificant flowers and red berries; has nothing much to recommend it.

Murraya exotica. An evergreen shrub of great excellence for hedges, making probably the best hedge in the Colony. It has dark green pinnate leaves, and in early Spring is covered with sweetly scented white flowers; there are only a few hedges to be seen at present, as it is most difficult to obtain good seed, and is very difficult to strike from cuttings. It also makes a fine shrub. Seeds.

Myrtus communis (Myrtle). Evergreen shrub, flowering freely in Spring; white. Seeds or cuttings.

Nerium oleander (Oleander). A hardy, strong shrub, growing to 15 feet, and providing a blaze of colour during most of the year; flowers salmon pink, also a white and a dark red variety. The shrub is cnsidered very poisonous. Cuttings.

Philadelphus grandiflorus (Mock Orange). Deciduous shrub up to 10 feet high; flowers in Spring usually before the leaves appear. Flower white. Cuttings.

Several varieties are grown, all with white flowers, some being double.

Pittosporum undulatum (Camphor Laurel). The favourite hedge plant in and around Salisbury, where miles of healthy hedges may be seen. It is a bright green in colour, has dense foliage and stands up to the dry winters better than would be expected. Is also a useful small shrubbery specimen tree. Seeds.

Plumbago capensis (Plumbago). A good, well known shrub, but deciduous unless watered during the dry season; has beautiful, light blue flowers. Seeds or cuttings. There is also a white variety.

Plumeria occulata (Frangipani). As below, but with creamy-white flowers. Cuttings.

Plumeria rubra (Frangipani). Has thick succulent branches and large dark green leaves; covered in Summer with terminal cymes of fragrant yellowish-pink flowers; is not hardy to very heavy frosts, and should be protected while small. Cuttings.

Poinciana gillessii (Bird of Paradise Flower). A small deciduous shrub, about 10 feet high, having in Summer masses of red edged with gold flowers, and is a beautiful object. Seeds.

Also a fine yellow variety similar to above. Seeds.

Poinsettia albida. A variety with pale yellow bracts, not so effective as the red, but useful in large shrubberies.

A rose-pink variety is also grown, but requires partial shade, otherwise the hot sun bleaches the bracts to a yellow colour. This variety is not a fixed type, and often reverts to single red. Cuttings.

Poinsettia pulcherrima. A shrub with red bracts growing to 12 feet in height, spreading; deciduous; the Poinsettia grows to perfection, but sometimes in exposed situations the flower bracts are damaged by frosts; heavy pruning is beneficial,

especially if large heads are required, and with a little attention can be grown with a diameter of 18 inches. Cuttings.

Poinsettia sp. A double form is also grown, and is valuable as it is of a darker red and flowers later than the single. Cuttings.

Psidium cattleyanum. Erroneously called the Chinese guava locally; this is an evergreen small shrub up to 6 feet high and bearing small dark purple fruits which look something like strawberries; well worth cultivation for the fruits. Seeds.

Punica granatum (Pomegranate). A shrub about 15 feet high; deciduous; single scarlet flowers, followed by large brightly coloured fruits. Seeds.

Also a double red flowered variety, and a double red-yellow flowered variety known are grown, double kinds propagated by cuttings as they do not bear fruits and are deciduous.

Pyracantha angustifolia (Yellow Berry Hawthorn). An excellent hedge shrub. Seeds.

Pyracantha crenulata (Red Berry Hawthorn). This and the variety above are very favourite hedge shrubs, and were sold by us as *Crataegus pyracantha* and *Crataegus oxycantha*, but the present names are correct. Seeds.

Rhamnus prinoides. An indigenous small shrub, having bright shiny leaves. Has been tried as a hedge fairly successfully, though many other plants are more suited for this purpose.

Rhynchospermum jasminoides or *Trachelospermum jasminoides* (Star or Malayan Jasmine). An evergreen dwarf creeping shrub, usually about 2 feet high, but can be trained up a trellis; is covered in Summer with clusters of small pure white flowers, highly scented. Cuttings.

Rosmarinus officinalis (Rosemary). A small shrub to 5 feet with small purple flowers; it is for the aromatic leaves the shrub is grown. Cuttings.

Salix purpurea (Osier Willow). One of the true Osiers, and valuable for basket making, and for which the weeping willow may also be used. This variety will grow to 10 feet in height, and will produce useful rods in two or three years. Cuttings.

Salvia involucrata. A large herbaceous shrub to a height of 8 feet in well prepared soil carrying large heads of rosy-crimson flowers in late Summer; requires feeding and cutting back each season for the best results; tender to frost. Cuttings.

Spiraea prunifolia (Cape May). A deciduous shrub, to 6 feet high, is covered in early Spring with masses of double white flowers; is sometimes used as a hedge. Cuttings.

A single white flowered variety is similar.

Streptosolen jamesonii. A favourite evergreen shrub, with large heads of small orange-red flowers, flowering profusely in June-July; the flowers are damaged by frost unless in a sheltered situation. Cuttings.

Tecoma smithii. A large yellow-flowered shrub, up to 15 feet high; deciduous; fast grower. Seeds.

Tecoma stans (Yellow Elder). Similar to *T. smithii*, but is not quite so large. Flowers reddish-yellow. Seeds.

Tecomaria capensis (Kaffir Honeysuckle). A straggly creeping shrub, but a pretty plant if care is taken of it; flowers reddish-orange. Seeds or cuttings.

Thevetia neriifolia. A bright-leaved evergreen shrub, tender to heavy frosts, golden yellow flowers. Seeds.

Tinnea aethiopica. A small shrub with reddish brown flowers, flowers have a delightful scent. Seeds or cuttings.

Tithonia speciosa. A small variety, to 4 feet wth single red flowers. Seeds.

Ulex europaeus (Furze, Gorse or Whin). This well known shrub grows well at Inyanga on the Eastern Border, about 6 feet in height; evergreen; golden yellow flowers. Seeds.

Viburnum opulus (*Guelder Rose*). A deciduous shrub; height up to 4 feet, large heads of white flowers; probably only successful on the Eastern Border. Cuttings.

Vitex angus-castus. A small shrub producing large spikes of salvia like flowers, lavender blue, very pretty, flowering about October-November. Seeds or cuttings.

Wigandia macrophylla. A large-leaved strong growing herbaceous shrub; height to 10 feet; has large terminal cymes of purple flowers. The whole plant is covered with fine spiny hairs, which if touched are very irritating; requires plenty of room to develop properly. Suckers.

3. CLIMBERS AND CREEPERS.

Actinidia chinensis. A deciduous climber bearing an edible fruit. This plant is dioecious, and so far we have only been able to raise the male plant. Seeds or cuttings.

Allamanda grandiflora. A beautiful golden flowered variety, and a strong climber, suitable as a verandah climber. Cuttings. Propagation difficult.

Ampelopsis quinquefolia. A large-leaved variety, of much coarser habit than *A. veitchii* and very hardy. Seeds and cuttings.

Ampelopsis veitchii (Virginia Creeper). A clmbing plant suitable for walls and rocks, to which it clings; proved to do best in this country on south walls. Seeds or cuttings.

Antigonon leptopus (Coral Creeper). A beautiful sight when a large plant is in full bloom; strong grower, deciduous and rather unsightly during the winter, unless grown with some other evergreen climber which will not kill it. Seeds.

Aristolochia elegans. Not so strong-growing as *A. sipho*, and with much smaller, brownish-red, flowers. Seeds.

Aristolochia sipho (Dutchman's Pipe). A strong climber, growing to a height of 25 feet, with curious flowers, of a purplish colour. Hardy. Seeds.

Aristolochia tomentosa (Dutchman's Pipe). A strong grower, requiring plenty of room; crimson-purple flowers. Deciduous. Seeds.

Beaumontia grandiflora. A large-leaved, vigorous climber, which requires plenty of room. One plant will easily cover a trellis 25 feet in length and 10 feet high; a quick grower, and flowers profusely; flowers large, trumpet-shaped and pure white, being very similar to *Lilium harrisii;* sometimes a little slow in becoming established. Seeds.

Bignonia cherere. A beautiful large flowered reddish-orange species; strong grower and climber. Propagation by layers, or budding.

Bignonia gracilis. A climber which will cling close to walls and trees, like Virginia Creeper, and is very useful where a plant is required to cover a dead tree stump. Has large sulphur yellow flowers, but only in flower for a short period yearly. Cuttings or seeds.

Bignonia jasminoides. A good climber which has evergreen bright shining leaves and large white flowers with purple throat. Seeds or cuttings.

Bignonia magnifica. A strong grower, evergreen, climbing, with mauve-pink flowers in profusion. Cuttings or layers.

Bignonia speciosa. A dwarf ground runner 2-3 feet in height and having mauve flowers. Cuttings.

Bignonia venusta (Golden Shower). Grows to perfection nearly everywhere; this gorgeous climbing plant is too well known to need description. Excellent alike for verandahs, pergolas, or even as a hedge, when it makes a wonderful show. Cuttings.

Bougainvillea splendens. This species and several others of this genus do remarkably well, and are useful as strong climbers; if trimmed into neat bushes, they make effective shrubs, and also make excellent hedges if kept in order. Layers or cuttings.

Clerodendron thompsonae or *balfourii.* A hardy climber, best grown on a wall; has bright flowers of pure white and scarlet. Cuttings.

Clitoria ternatea (Mussel Shell Creeper). A strong climber, with delightful blue flowers. Seeds or cuttings.

Cobaea scandens. A strong climber, and will cover considerable space; reddish-purple flowers and very useful where a quick climber is needed. Seeds.

Cryptostegia grandiflora. A rough and strong half climber, but usually grown as a shrub, has fine pinkish-mauve trumpet-shaped flowers, and shiny green foliage. Seeds.

Ficus repens. A clinging fig, suitable for stonework or walls, to which it clings very closely; small leaves; evergreen; the young leaves are a brownish red, which are very attractive. Cuttings.

Hedera helix (Ivy). Too well known to need description; the ivy needs shade and cool conditions, even then is not very successful here. Cuttings.

Lantana salviaefolia. Grows to 18 inches at the most, and is useful for edgings; has pretty pink flowers; does not seed; useful on rockwork; hardy. Cuttings.

Lonicera periclymenum (Common Honeysuckle). A very hardy and rapid climber, flowering freely; needs regular attention to keep it neat. Cuttings.

Lonicera sempervirens (Trumpet Honeysuckle). A rapid climber; hardy; evergreen; scarlet flowers in profusion; flowers long tubular trumpet shaped. Cuttings.

Also yellow variety similar to above. Cuttings.

Maclura aurantiaca (Osage Orange). A very thorny and strong grower, of a semi-climbing habit; is useful as a cattle proof hedge. Seeds or cuttings.

Mandevilla sauveolens. A strong and hardy climber, with clusters of large white scented flowers in summer. Seeds.

Maurandia antirrhiniflora. A hardy evergreen climber; strong grower; has small ivy-like leaves, and is usually covered with flowers of different shades of blue, pink or white; it is a very good plant for use on tennis court wiring, but the top of the wire fence should be strengthened with piping to hold the weight. Seeds.

Monstera deliciosa. A large leaved evergreen climbing plant bearing an edible fruit; its leaves are the main attraction, these are about 2 feet long, and over 1 foot wide, and are perforated in an unusual way; is a good plant in a warm situation, and planted against a tree for it to climb; it must have some shade. Offsets.

Passiflora caerulea. A useful very rapid climber; evergreen; has not fruited here.

Passiflora edulis (Granadilla). This evergreen climber is well known as it grows like a weed nearly everywhere; produces purple fruits in abundance. Seeds or cuttings.

Passiflora quadrangularis. This variety is similar to the above, but has larger fruits. It does not grow so readily as *P. edulis.*

Passiflora sp. (Fiji Granadilla). A large-leaved heavy climber, with large yellow fruits; is good as a strong climber; fruits, however, do not really come to perfection here.

Passiflora sp. A pretty pink flowered variety; useful evergreen climber bearing long narrow yellow fruits.

All are raised by seeds or cuttings, and all are tender to heavy frosts; young plants must be protected during cold weather.

Pereskia aculeata (Barbados Gooseberry). An exceedingly rank and thorny creeper, even the small fruits are covered with spines; makes a good cattle proof fence. Cuttings.

Petraea volubilis (Purple Wreath). A straggly climber, which may be trained into a shrub; deciduous; flowers in Spring; has long racemes of deep purple-coloured flowers and is a beautiful object; small plants tender to frosts. Propagated by layers or cuttings.

Phaseolus lunatus (Seven-Year or Lima Bean). A most luxuriant climber, which is useful as a quick growing screen; deciduous, but the vines live and throw out new growth early in Spring; is a good table bean; the dry beans soaked and boiled are an excellent vegetable. Seeds.

Podranea brycei (Zimbabwe Creeper). An indigenous creeper, and a rank grower in cultivation, but when in flower it makes a wonderful show with its large heads of pink flowers. Seeds or cuttings.

Pueraria thumbergiana (Kudzu Vine). Useful rough creeper, with dense green foliage, used sometimes as a climber on trellis work; is a valuable fodder plant and grows to perfection here for this purpos. Layers, seeds or crowns.

Rosa bracteata (Macartney Rose). A very strong-growing climbing rose; evergreen; flowers profusely in Spring; has large single white flowers; makes an excellent cattle proof hedge, and looks well if regular attention is given to it; but if allowed to grow unchecked becomes very straggly. Cuttings.

Senecio macroglossus (Cape Ivy). An evergreen climber, bright shiny leaves, and large single yellow flowers; is a rapid and showy climber. Cuttings.

Solanum seaforthianum. A small flowered variety of the potato creeper, growing to 8 feet; evergreen climber; pretty blue flowers, followed by bright red berries. Seeds or cuttings.

Solanum wendlandii (Potato Creeper). A strong-growing rough climber, requiring plenty of room, such as a windmill tower, to show it to best advantage; damaged by frost. Cuttings.

Stephanotis floribunda (Madagascar Jasmine). An evergreen climber with dark fleshy leaves and lovely white scented flowers; requires partial shade and will do on a "outh wall. Seeds.

Wistaria chinensis (Chinese Kidney Bean Tree). This well known climber, although odd plants grow well, does not flower very readily. Seeds.

4. PALMS, BAMBOOS, ETC.

Agapanthus umbellatus (African Lily). A well known plant, which although not a shrub, is usually used in shrubbery work,

where it is very useful near the edges of the shrubbery. Seeds or offsets.

Agave americana (Aloe). The American aloe with large leaves which are glaucous-green and fleshy; useful on rockeries and in shrubberies. Suckers. A variegated variety which is very showy is used in shrubberies.

Agave rigida (Sisal). Both the plain and spiny-leaved kinds grow to perfection; leaves from three to five feet in length; are very useful for thatching and tying purposes. Natives crush the leaves slightly and strip them down to make "tambo," which for thatching purposes lasts as long as the thatch. Bulbils or suckers.

Aralia sieboldii. The well known pot plant. Seeds or cuttings.

Arunda donax (Spanish Reed). A strong reed, up to 25 feet in height in a good soil with plenty of moisture; has a diameter of an inch and is very useful for garden sticks and numerous other purposes. Offsets. A variegated variety is very ornamental.

Asparagus plumosus (Asparagus Ferns). This plant grows to perfection with very little effort, and varieties are to be found growing in the veld. Seeds or divisions of roots.

Asparagus sprengeri. A useful kind for hanging baskets; fronds about two feet in length and has at one period of the year tiny white flowers. Scented. Divisions of roots or seeds.

Bambusa arundinacea (Whipstick Bamboo).. The stems of this species are up to 50 feet, when grown in heavy rich soils and have diameters up to 5 inches; for whipsticks it should be grown in poor or gravelly soil. Offsets.

Bambusa fortunei (Fortune's Bamboo). A small variety having a height of about 6 feet and stems about half an inch thick; valuable in clumps in a shrubbery and can also be used as a hedge; stems are very handy as stakes in a garden. Offsets.

Bambusa vulgaris. A strong-growing bamboo, with blackish stems 2 to 3 inches in diameter, and 15 feet high. Offsets.

Bambusa sp. (Striped Bamboo). Height to 15 feet, diameter 3-4 inches; has golden stems marked with green stripes. Offsets.

Bambusa sp. An Indian species raised from seed brought over by Mr. A. C. Laurie, Glendale, and though not yet fully grown has reached 20 feet in height. Offsets.

Caryota urens (Mari Palm). A very handsome palm, slow growing, on the dry side for this palm in Salisbury. Seeds difficult.

Chamaerops elegans. A slow-growing, but useful palm, has fan-shaped leaves; has reached 10 feet in height. Seeds.

Chamaerops excelsa. A palm similar to above. Seeds.

Chamerops humilis (Palms). A small palm suitable for the rockery. Seeds.

Cocos australis (Large Palm). A slow growing palm, large glaucous fronds, very handsome. Seeds.

Cocos plumosa. A fine palm, tall-growing, with large feathery leaves. Seeds. Difficult to germinate.

Cocos Weddelliana (Palm). A very fine small palm for indoor work. Seeds.

Cortaderia argentea (Pampus Grass). Growing to 8 feet high, is a handsome plant, with its long plumes of white seed heads; best grown near a leaky tap, or in the water garden. Offsets.

Cyathea dregei (Tree Fern). Many thousands are to be seen, standing like long lines of sentinels, on the Inyanga plateau, and show where there is running water; they range from a few inches to 15 feet in height; can be grown successfully in tubs, but require a sheltered verandah away from the prevailing winds, when cultivated. Plants.

Cyperus papyrus (Papyrus Grass). Indigenous to the Colony; this handsome grass will thrive if planted near a leaky tap, and will reach a height of 10 feet in suitable places. Offsets.

Dahlia imperialis (Tree Dahlia). A tall perennial dahlia, about 8 feet in height; has fine heads of large single flowers, of a pinkish-white and is useful in a large shrubbery. Dies to the ground each year after flowering. Hardy. Seeds.

Dasylirion sp. Several of these have been grown, and are suitable for rock work. Seeds.

Dendrocalamus strictus (Bamboo). A useful solid stemmed bamboo; about 15 feet in height and diameter of one inch; narrow leaves. Offsets.

Dracaena reflexa. A large species, growing to a height of 20 feet, leaves bright green, long and broad; excellent in the shrubbery for its tropical effects. Seeds or cuttings.

Fourcroya gigantea (Mauritius Hemp). Grows to perfection; has long leaves similar to *Agave rigida*, but of a yellowish green colour, and about 5 feet long; the flowers are produced on long poles 15-20 feet in height, and are white; these are attractive in February-March and show up well in a large shrubbery. Suckers or bulbils. A variegated variety, is very ornamental.

Kentia belmoreana or *Howea belmoreana* (Curly Palm). Handsome palms; require protection of shade house or verandah; there are other species of the same genus. Seeds.

Kniphofia rooperi. Commonly called Red Hot Poker; an indigenous aquatic plant found growing in vleis or wet ground; can be grown successfully near a leaky tap or water garden. Division of roots.

Latania borbonica or *Livistona chinensis* (Bourbon Palm). A handsome fan palm, suitable for the verandah or sheltered position outdoors. Seeds.

Musa ensete. A banana-like plant, indigenous to the Colony, growing to a height of 12 feet, along the Eastern Border, and always in sheltered places which are inclined to be wet. The plant lives about 12 years, then flowers and dies; the fruits are like bananas, but are filled with hard seeds about three-eighths of an inch in diameter, and from these plants are easily raised. Seeds.

Nephrolepis sp. (Sword Ferns). Beautiful tender ferns, suitable for the verandah and having remarkable variations in the fronds; some are very useful for hanging baskets. Divisions.

Nymphaea spp. (Water Lily). A genus of water plants with beautiful flowers and suitable only in the water garden. The common Rhodesian species has bluish-white flowers, but there are a number of other colours to be had by importation; easily transplanted from rivers to the private pond. Roots.

Osmunda regalis (Royal Fern). A hardy fern requiring shade and damp conditions; is to be found in cart loads along rivers in the Enterprise District. Roots.

Oxytenanthera abyssinica (The Bindura Bamboo). Indigenous to the Colony, strong grower producing very useful solid bamboos about one inch in thickness. The ripe bamboos are rather soft-skinned and take the borer very easily, so should be treated before use. Offsets.

Phoenix canariensis. A species of the date palm, with large fronds; will make a good specimen; hardy. Seeds.

Phoenix dactaylifera (Common Date Palm). The date of commerce thrives slowly, making in time a handsome specimen, but will probably not fruit here; it is probable, however, that a place may be found in the Colony where it will bear fruit. Seeds.

Phoenix reclinata (False Date Palm). A palm of the date family which is indigenous to the Colony and reaches a height of 15-20 feet; graceful and hardy. Seeds.

Phormium tenax (New Zealand Flax). A useful ornamental plant, with sword-like leaves, up to 6 feet in height; the leaves are thrown out from the base at ground level; it is valuable fibre plant, and there are lots of uses to which the leaves can be put, such as thatching, tying up plants, etc.; the dead and old leaves soaked in water and pulled into strips makes an excellent tying material. Offsets or seeds.

Also a variegated variety, is very ornamental.

Physalis peruviana (edulis) (Cape Gooseberry). The well known Cape Gooseberry, usually grows like a weed, and fruits profusely. Seeds.

Rhapis flabelliformis. A slender palm, about 4 feet high, fan-leaved, with narrow leaflets, useful as a verandah plant; it throws up suckers from which it is propagated.

Ricinus communis (Castor Oil Plant). From the frequent occurrences of this plant in the veld in the Inyanga district I

conclude that it is probably indigenous to the Colony; it is very easily grown and has been seen growing naturally to a height of 10 feet. Some of the highly coloured varieties would probably do well and be a useful addition to our shrubberies. Seeds.

Romneya coulteri (Californian Poppy). Shrubby herbaceous plant producing large single white scented flowers; evergreen; height to 6 feet. Suckers.

Roses. Roses, of the hybrid, hybrid teas, polyanthas, and one or two of the climbing polyanthas and Winchurian do well in the heavy soil districts, but many of the good climbing varieties will not thrive and flower freely, unless in the mist belt.

The best results with hybrid perpetuals and hybrid teas are obtained from plants raised from cuttings; plants on stock are a perfect nuisance, as they are always throwing out suckers if the roots are at all damaged while cultivating.

Russelia juncea (Coral Fuschia). A charming plant suitable for the edge of the shrubbery, growing to about 4 feet high, and throwing out new growth from the base; like asparagus. Has large spikes of small red flowers, which are excellent for cutting. Cuttings.

Sabal blackburniana (Palm.) Very slow growing palms, but worth while as the fronds are very handsome. Seeds.

Other varieties have also been grown.

Seaforthia elegans or *Ptychosperma cunninghamiana* (Illawara Palm). A fine large palm for verandah, or shade house, but will not stand the sun. Seeds.

Smilax sp. Deciduous climbers, sending out new growth yearly; useful shade house plants. Two or three varieties are indigenous to the Colony. Seeds or roots.

Strelitzia augusta. Indigenous on the Eastern Border, handsome banana-like plant useful for tropical effects. Offsets or seeds.

Strelitzia reginae (Crane's Head). A large herbaceous plant useful for the shrubbery; grows up to 5 feet in height and has large leaves something like the canna; produces curiously shaped flowers which strikingly resemble a Crane's head. Division of roots.

Tithonia diversifolia. A large herbaceous shrub, growing to a height of 10 feet, dying down to the crown each winter; large spikes of yellow flowers very similar to sunflowers. Seeds. Offsets.

Washingtonia robusta (Cotton Palm). A very fine hardy palm for avenues, or specimen purposes, and is fast growing; requires deep well-drained soil, and has done best on raised mounds. Seeds.

Zantedeschia africana (Arum Lily). Although such a common plant in the Cape, this plant requires regular attention to grow to perfection in this Colony, and is best grown in the shade house or verandah. A pretty yellow species (*Z. melanoleuca*, Engl.) is indigenous to the Colony, and very common. Division of roots.

Rhodesian Milk Records.

OFFICIAL MILK RECORDS.

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Matopo Ruth	Red Poll	Mature	5277.70	232.15	4.40	300	Matopo School of Agriculture, Rhodes Matopo Estate, Bulawayo.
Matopo Ruby	Red Poll	Mature	5104.80	207.71	4.07	300	
Matopo Toss	Red Poll	Senior 3 yrs	4286.90	173.86	4.05	244	

SEMI-OFFICIAL MILK RECORDS.

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Kamakoza	G. Friesland	Mature	9431.00	347.66	3.69	300	R. A. Ballantyne, Box 801, Salisbury.
Chimsoro...	G. Friesland	Mature	8326.00	285.68	3.43	300	
Molly II.	G. Shorthorn... ...	Mature	6650.20	264.45	3.98	300	J. H. Barry, Box 209, Umtali.
Monica	G. Shorthorn... ...	4 years	5651.60	250.16	4.60	278	
Samson	G. Friesland	Mature	7877.70	319.00	4.05	300	J. A. Baxter, Box 1368, Salisbury.
Napoli	G. Friesland	Mature	7048.00	258.03	3.66	300	
Siman C.6	G. Friesland	Mature	6182.40	236.16	3.82	300	
Winston C....	G. Friesland	Mature	7360.50	302.19	4.11	300	
Japan...	G. Friesland	Mature	9626.90	315.65	3.28	300	
Mount Darwin... ...	G. Friesland	Mature	8314.00	260.45	3.13	300	
Elizabeth	G. Friesland	Mature	9766.90	367.73	3.77	300	
Donsor I.	G. Friesland	Mature	7577.60	276.08	3.63	300	Mrs. D. Black, Burnside, Bindura.
D57	G. Friesland	Mature	7949.20	300.89	3.79	300	A. L. Bickle, Box 595, Bulawayo.
D117...	G. Friesland	3 years	6520.10	226.95	3.48	300	
D84	G. Friesland	4 years	6837.90	256.28	3.75	286	
D90	G. Friesland	4 years	6733.40	255.16	3.79	276	
D102...	G. Friesland	4 years	9797.90	398.77	4.07	300	
J69	G. Friesland	Mature	6558.00	242.80	3.70	268	
No. 69...	G. Friesland	Mature	7413.20	251.42	3.39	300	
D97	G. Friesland	3 years	8652.70	294.95	3.41	295	
J53	G. Friesland	Mature	10053.70	303.45	3.10	300	
D103	G. Friesland	4 years	9662.50	360.12	3.73	300	
D51	G. Friesland	Mature	9045.20	314.52	3.49	300	

D26	G. Friesland	Mature	9179.20	324.02	3.53	300	
D83	G. Friesland	4 years	7734.50	241.85	3.13	284	
J61	G. Friesland	Mature	10042.50	316.51	3.15	300	
Albertvale Bok-wagen	P.B. Friesland ...	Mature	9908.90	376 85	3.80	300	
Albertvale Bontrok	P.B. Friesland ...	Mature	10538.00	364.98	3.47	300	
Speur	G. Friesland	Mature	7781.80	262.00	3.37	297	Daisyfield Orphanage, P.O. Daisyfield.
Hartjie	G. Friesland	Mature	6430.60	264.08	4.11	300	
Susie	G. Friesland	Mature	7775.50	288.96	3.72	300	
Oubliette...	G. Friesland	3 years	6080.40	236.93	3.90	300	Thos. Cousins, P.B. 20, Gwelo.
R159...	G. Friesland	3 years	6597.10	240.29	3.64	300	J. B. Dold, Box 1153, Salisbury.
P168...	G. Friesland	Mature	8712.70	325.11	3.73	300	
No. 158...	G. Friesland	Mature	10656.00	365.55	3.43	300	R. le S. Fischer, Wakefield, Headlands.
No. 187...	G. Friesland	Mature	10627.00	351.22	3.31	300	
No. 45	G. Friesland	4 years	8977.00	297.67	3.32	254	
No. 193...	G. Friesland	Mature	11294.00	391.15	3.46	300	
No. 116...	G. Friesland	2 years	7663.00	276.73	3.61	300	
No. 112...	G. Friesland	2 years	7636.00	250.51	3.28	300	
No. 46	G. Friesland	4 years	7611.00	239.94	3.15	247	
No. 35	G. Friesland	4 years	9068.00	337.45	3.72	238	
Violet	G. Friesland	Mature	6129.00	236.75	3 86	234	The Hon. Humphrey Gibbs, P.B. 52L, Bulawayo.
Biddy	G. Friesland	Mature	6156.00	241.56	3.92	300	
Polly	G. Friesland	Mature	6866.00	260.12	3.78	272	
Isobel	G. Friesland	Mature	8841.00	292.54	3.31	300	
Judith...	G. Friesland	Mature	8259.00	293 92	3.56	300	
Butter...	G. Friesland	Mature	8052.00	288.79	3.58	300	
Evelyn	G. Red Poll	Mature	7715.00	248.20	3.22	300	
Val	G. Friesland	Mature	6456.00	229.80	3.56	219	
Nell	G. Friesland	4 years	7030.00	253.95	3.61	300	
Pixie	G. Friesland	Mature	6921.00	252.37	3.65	300	
Jessie	G. Friesland	4 years	7180.00	259.56	3.61	300	
Gerry	G. Friesland	Mature	9036.00	327.09	3.62	300	
Vida	G. Devon/Fries.	3 years	5706.50	231.81	4.06	300	Sir G. M. Huggins, K.C.M.G., C.H., F.R.C.S., M.P., Box 671, Salisbury.
No. 288	G. Friesland	Mature	6163.50	226.11	3.67	300	W. F. Fischer, Coldstream Ranch, Headlands.
Merry	G. Friesland	4 years	6801.00	225.11	3.31	272	D. J. Huddy, Box 718, Salisbury.

SEMI-OFFICIAL.—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
No. 185	G. Red Poll	3 years	5905.90	248.25	4.20	300	Matopo School of Agricaulture, P.I 19K, Bulawayo.
No. 107	G. Red Poll	Mature	7586.20	317.54	4.19	300	
No. 141	G. Red Poll	Mature	9394.20	362.66	3.86	300	
No. 80	G. Red Poll	Mature	6354.00	249.90	3.93	263	D. S. Kabot, Box 261, Bulawayo.
No. 50	G. Friesland	Mature	9932.00	395.87	3.99	295	
No. 44	G. Friesland	2 years	6651.00	285.23	4.29	300	
No. 42	G. Friesland	Mature	8703.00	310.10	3.57	300	
No. 1	G. Friesland	Mature	16395.00	569.39	3.47	300	
No. 79	G. Friesland	Mature	12034.00	477.06	3.96	300	
No. 27	G. Friesland	Mature	8763.00	373.66	4.27	300	
No. 66	G. Friesland	Mature	6397.00	245.98	3.84	300	
No. 32	G. Friesland	Mature	6943.00	337.46	4.86	300	
No. 20	G. Friesland	Mature	10143.00	357.04	3.52	300	
No. 69	G. Friesland	Mature	8630.00	300.35	3.48	300	
K.14	G. Friesland	4 years	7291.30	254.42	3.49	300	B. H. Kew, Box 972, Bulawayo.
K.4	G. Friesland	Mature	9498.40	287.37	3.03	300	
No. 358...	G. Guers/Fries.	Mature	6535.20	305.91	4.70	243	J. R. McLaren, Safago, Gwelo.
Sheila	G. Ayrshire	Mature	4227.30	264.27	6.25	259	J. H. McLean, Box 161, Gwelo.
Kempie	G. Friesland	Mature	6822.30	308.71	4.52	300	
Gundwane	G. Friesland	4 years	5276.50	252.31	4.78	300	J. U. McCay, P.B. J181, Bulawayo.
Rosie	G. Friesland	Mature	6275.30	248.89	3.97	296	
No. 19/8	G. Friesland	Mature	7621.00	263.42	3.46	300	Meikle Bros., Leachdale Farm, Shangani.
No. G 20/9	G. Friesland	Mature	8647.00	313.43	3.62	270	
No. 12/7	P.B. Friesland ...	Mature	8599.00	272.80	3.17	285	
No. P 29/0	P.B. Friesland ...	Mature	7054.00	245.10	3.47	300	
No. 6/7	P.B. Friesland ...	Mature	10143.00	340.57	3.36	300	
No. 19/9	G. Friesland	Mature	8056.00	342.44	4.25	300	
No. P 7/8	P.B. Friesland ...	Mature	11420.00	351.37	3.08	300	
No. P 4/1...	P.B. Friesland ...	4 years	7254.00	266.42	3.67	300	
No. G 22/7	G. Friesland	Mature	9958.00	330.83	3.32	300	
No. 187	G. Friesland	Mature	9549 00	344.44	3.61	300	

No. 11/7	G. Friesland	Mature	11355.00	429.28	3.78	300	
No. G 20/0	G. Friesland	Mature	8062.00	285.65	3.54	300	
No. 13/8	G. Friesland	Mature	12441.00	378.71	3.04	300	
No. G 10/9	G. Friesland	Mature	7095.00	233.19	3.29	266	
No. 21/7	G. Friesland	Mature	6694.00	260.15	3.89	249	
No. 213	G. Friesland	Mature	6624.00	256.79	3.88	161	
Sheep Run Dorina	P.B. Friesland ...	Mature	13446.50	466.21	3.47	300	W. S. Mitchell, Springs, Iron Mine Hill.
Sheep Run Lily's Countess	P.B. Friesland ...	Mature	10035.50	358.59	3.57	300	
Prudence A.	P.B. Friesland ...	Mature	11058.00	358.66	3.24	300	
No. 4	G. Friesland	Mature	10642.00	386.11	3.63	300	J. Picken, Iron Mine Hill, P.O. Iron Mine Hill.
Clover...	G. Friesland	Mature	6656.20	299.59	4.50	298	D. W. Marshall, Box 164, Umtali.
Picanin	G. Shorthorn... ...	4 years	8612.00	358.85	4.17	300	F. Muggleton, Steynstroom, Umtali.
Carlton Primrose	Reg. Shorthorn...	Mature	6048.50	233.00	3.85	252	
Mziki	G. Friesland	3 years	6236.00	229.71	3.68	300	Kenneth Norvall, Box 637, Bulawayo.
Maisie	G. Friesland	Mature	9146.00	291.17	3.18	300	
Mafrag	G. Friesland	3 years	6912.00	227.97	3.29	300	
Cherry I....	G. Friesland	3 years	7650.00	297.40	3.89	300	
Countess of Cartrep	P.B. Friesland ...	Mature	15551.00	545.56	3.51	300	
Betty	G. Friesland	Mature	8375.60	313.46	3.74	278	E. Palmer, Ferndale, Penhalonga.
Sbanda	G. Friesland	Mature	6978 00	296.62	4.25	268	Mrs. M. Rogers Bickford, Gwelo.
Bella	G. Friesland	Mature	4870.50	235.74	4.84	245	
No. 14 Harriet ...	G. Friesland	Mature	5949.60	241.56	4.06	300	Mrs. D .H. Rutherford, Box 25, Marandellas.
No. 15 Bridgit... ...	G. Friesland	2 years	6974.90	245.21	3.52	300	
No. 3 Gracie	G. Friesland	Mature	5848.80	234.57	4.01	277	
Maswina	G. Friesland	2 years	5455.50	228.84	4.19	300	W. F. H. Scutt, Maple Leaf, Norton.
Tumeyu	G. Friesland	3 years	9062.20	313.88	3.46	300	
Legina	G. Friesland	3 years	9008.80	326.81	3.63	300	
Battle Fame	Reg. Ayrshire ...	Mature	6313.00	273.89	4.34	300	J. R. Stewart & Sons, P.O. Shangani.
P. 4	G. Ayrshire	Mature	6307.00	226.91	3.60	300	
No. 10...	G. Ayrshire	4 years	6345.50	257.02	4.05	300	

SEMI-OFFICIAL.—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Kirstie	G. Friesland	Mature	8660.00	288.24	3.33	178	W. E. Tongue, Box 199, Bulawayo.
Bessie	G. Red Poll	3 years	5172.50	277.75	5.37	265	N. W. Whitehead, Lonsdale Farm, P.O. Matopos.
Jenny	G. Red Poll	3 years	5118.70	256.09	5.00	257	
Gracie...	G. South Devon...	Mature	4462.50	273.45	6.13	243	
Night	G. Red Poll	Mature	5084.40	227.09	4.47	249	
Coffee	G. South Devon...	Mature	6495.00	330.67	5.10	300	
Sweet	G. Red Poll	Mature	7017.20	286.33	4.08	300	
Ruby	G. Red Poll	Mature	5808.00	293.90	5.06	300	
Cherrie	G. South Devon...	Mature	5762.50	285.55	4.96	296	
Daisy	G. Friesland	3 years	6956.30	251.58	3.62	300	Mrs. M. Turnbull, Box 479, Bulawayo.
Betty	G. Friesland	Mature	9436.40	340.64	3.61	300	
Annie	G Friesland	2 years	7645.00	267.55	3.50	300	
Fin...	G. Friesland	Mature	8581.70	290.32	3.39	300	

HERD AVERAGES 1945-1946.

These averages are for cows which completed a lactation during the period 1.10.45 to 30.9.46. The records of cows which died or were sold before completing 200 days or which were withdrawn from test by permission of the Chief Dairy Officer are not included. Averages are not given also for those herds in which the number of cows completing a lactation during this period was less than five.

OFFICIAL MILK RECORDS.

Owners Name and Address.	Breed.	Milk lbs.	% B. Fat	B. Fat lbs.	Days
J. Jamieson, Criterion, Bulawayo	Friesland	10823.9	3.60	389.2	296
R. R. Sharp, Whinburn, Redbank	Friesland	9219.1	3.71	342.0	298
Meikle Bros., Leachdale, Shangani	Friesland	8900.5	3.45	306.9	296
T. C. Pascoe, Crowborough, Salisbury	Friesland	8626.7	3.51	303.3	295
Matopos Agricultural School, Bulawayo	Red Poll	6776.2	3.85	260.9	284

Owners Name and Address.	Breed.	Number of Cows.						
		2 year old	Junior 3 years	Senior 3 years	Junior 4 years	Senior 4 years	Mature	Total
J. Jamieson, Criterion, Bulawayo	Friesland	1	—	1	2	—	3	7
R. R. Sharp, Whinburn, Redbank	Friesland	8	2	4	2	5	7	28
Meikle Bros., Leachdale, Shangani	Friesland	—	—	—	—	1	8	9
T. C. Pascoe, Crowborough, Salisbury	Friesland	4	—	1	1	6	6	18
Matopos Agricultural School, Bulawayo ...	Red Poll	—	3	2	1	2	14	22

Average: 8552.0 lbs. Milk; 312.6 lbs. B. Fat; 3.66% B. Fat; 293 Days.
Average No. Cows: 17.

Semi-Official Milk Records.

HERD AVERAGES — (Continued).

Name.	Breed.	Milk lbs.	% B. Fat	B. Fat lbs.	Days	Cows
Grasslands Expt. Station, Marandellas	G. Friesland	11113.0	3.57	396.8	297	21
J. Jamieson, Bulawayo	Friesland	10700.2	3.61	386.2	296	35
W. S. Mitchell, Iron Mine Hill	G. Friesland	10241.3	3.44	352.2	313	22
J. R. McLaren, Gwelo	G. Friesland & Guernsey	7427.0	4.22	313.2	277	37
Mrs. L. M. H. Howard, Beatrice	G. Guernsey	7286.4	4.27	311.3	300	16
A. L. Bickle, Bulawayo	G. Friesland	8500.5	3.65	310.0	295	65
D. S. Kabot, Bulawayo	G. Friesland	7933.5	3.86	305.8	295	45
R. Le S. Fischer, Headlands	G. Friesland	8620.3	3.45	297.4	284	85
W. E. Tongue, Bulawayo	G. Friesland	8530.0	3.32	283.2	275	24
B. H. Kew, Bulawayo	G. Friesland	7182.8	3.80	273.0	296	32
Matopo Expt Station, Bulawayo	G. Red Poll	6848.8	3.97	271.8	288	19
W. F. H. Scutt, Norton	G. Friesland	7655.1	3.54	271.1	296	47
F. B. Morrisby, Gwelo	G. Friesland	7700.0	3.51	270.3	290	58
Mrs. M. Turnbull, Bulawayo	G. Friesland	7688.6	3.51	270.3	292	14
W. Sole, Glendale	G. Friesland	7474.4	3.59	268.1	268	28
J. R. Bedford, Marandellas	G. Friesland & Guernsey	6414.5	4.16	266.8	291	15
P. Freeland, Gwelo	G. Friesland	7347.0	3.56	261.9	291	70
F. Muggleton, Umtali	G. Shorthorn	6471.8	4.04	261.4	289	11
E. Tapson Trust Ltd., Rusape	G. Friesland & Ayrshire	6987.0	3.68	257.2	281	112
A. C. De Olano, Bromley	G. Friesland	7401.5	3.42	253.2	289	20
Meikles Trust Ltd., Shangani	Friesland	7275.0	3.47	252.3	278	148
L. E. O. Cary, Trelawney	G. Shorthorn & Ayrshire	6544.9	3.84	251.5	300	5
D. L. Cameron, Fort Victoria	G. Friesland	6417.7	3.89	249.5	282	18
H. C. Fischer, Headlands	G. Friesland	6894.1	3.59	247.4	284	40
C Boyd Clark, Inyazura	G. Friesland	6692.4	3.67	245.3	272	22
Estate D. Black, Bindura	G. Friesland	6711.9	3.62	243.2	293	20
J. H. Barry, Umtali	G. Shorthorn & Afrikander	5966.5	4.06	242.5	280	61
D. J. Huddy, Salisbury	G. Friesland	6904.6	3.49	241.0	279	57
Gwebi Government Farm, Gwebi	G. Friesland	7239.5	3.32	240.7	285	20
H. Knill, Marandellas	G. Friesland	6684.4	3.60	240.3	291	7
J. A. Baxter, Salisbury	G. Friesland	6734.8	3.55	238.8	296	128

Comdr. E. L. Morant, Salisbury	G. Friesland & Ayrshire	6182.1	3.76	232.7	285	26
E. Palmer, Penhalonga	G. Friesland & Shorthorn ...	6415.0	3.65	231.3	268	34
H. G. Enslin, Fort Victoria	G. Friesland	6280.8	3.68	230.9	293	17
G. J. Franklin & Son, Umtali	G. Friesland	5892.4	3.91	230.7	284	103
K. Norvall, Bulawayo	G. Friesland	6588.1	3.49	230.1	276	40
Mrs. M. Everard, Inyazura	G. Friesland	6233.1	3.64	226.9	276	33
D. J. Coetzee, Chipinga	G. Friesland	6081.8	3.72	226.5	282	5
Daisyfield Orphanage, Gwelo	G. Friesland	6152.8	3.65	224.7	277	16
Miss I. van Niekerk, Rusape	G. Friesland	6514.7	3.44	224.0	297	9
Sir G. M. Huggins, Enterprise	G. Friesland	6403.2	3.50	223.8	298	17
D. W. Marshall, Umtali	G. Friesland	6216.4	3.58	222.3	280	12
G. Anderson, Gwelo	G. Friesland	5830.7	3.75	218.6	292	42
W. F. Fischer, Headlands	G. Friesland	6062.3	3.60	218.1	279	98
Lieut.-Col. C. I. F. Maynard, Melfort	G. Jersey	4705.2	4.63	217.9	286	20
J. B. Dold, Salisbury	G. Friesland	6398.1	3.37	215.8	287	48
Red Valley Estate Marandellas	G. Friesland	5836.6	3.70	215.0	289	9
Estate A. J. Harley, Marandellas	G. Guernsey	5017.0	4.28	214.7	245	27
T. Cousins, Gwelo	G. Friesland	6116.9	3.49	213.5	283	43
Hon. H. V. Gibbs Bulawayo	G. Friesland	6745.5	3.16	213.5	275	96
R. H. Greaves, Nyamandhlovu	G. Friesland	5821.7	3.66	213.0	260	14
A. M. Tredgold, Bulawayo	G. Red Poll	5189.3	4.07	211.3	289	58
D. King, Concession	G. Friesland	5628.3	3.73	209.9	261	25
J. T. Mungle, P.O. Odzi	G. Friesland	5030.5	4.11	207.0	284	26
N. W. Whitehead, P.O. Matopos	G. Red Poll	4592.5	4.46	204.8	265	32
D. H. Rutherford (Mrs.), Marandellas	G. Friesland	5406.9	3.78	204.4	292	10
J. G. Thurlow, Bindura	G. Friesland & Red Poll	5193.3	3.93	204.0	275	47
A. W. Tennent, Headlands	G. Friesland	5698.7	3.58	203.9	280	54
P. Linton, Salisbury	G. Friesland	5677.8	3.55	201.7	279	56
Mrs. M. Rogers, Gwelo	G. Friesland	5042.2	3.97	200.4	275	22
D. A. Harley, Beatrice	G. Guernsey	5007.5	4.00	200.1	278	100
L. Huddy, Salisbury	G. Friesland	5527.2	3.61	199.4	252	73
Mutambara Mission(Cashel	G. Friesland	5187.7	3.81	197.5	269	15
T. W. V. Cross, Bulawayo	G. Friesland	5722.2	3.48	195.0	287	27
Mrs. M. Krahner Banket	G. Friesland	5216.8	3.73	194.8	292	22
T. C. Pascoe, Salisbury	G. Friesland	5259.0	3.66	192.5	291	103
J. H. McLean, Gwelo	G. Friesland & Red Poll	4945.2	3.88	192.2	256	50
J. Picken, Iron Mine Hill	G. Friesland	5329.0	3.60	191.7	291	28
Susman & Newfield, Salisbury	G. Friesland	5293.8	3.56	188.2	269	22
G. R. Morris, Salisbury	L.R. Shorthorn ...	4633.9	4.05	187.8	255	12

SEMI-OFFICIAL MILK RECORDS—(Continued).

Name.	Breed.	Milk lbs.	% B. Fat	B. Fat lbs.	Days	Cows
J. U. McCay, Bulawayo	G. Friesland	5443.6	3.44	187.3	277	52
E. E. C. Green, Bulawayo	G. Friesland	4866.4	3.81	185.4	275	7
J. R. Stewart & Son, Shangani	G. Ayrshire	4887.3	3.76	184.0	278	22
H. T. Kirkup, Salisbury	G. Friesland	5379.7	3.41	183.4	285	56
F. B. Smith, Hartley	G. Friesland	4212.8	4.28	180.5	272	7
Mrs. S. Worthington Reed, Gwelo	G. Friesland	4744.3	3.78	179.6	285	35
Mrs. V. Stead, Gwelo	G. Friesland & Red Poll	4434.8	4.05	179.5	269	20
A. P. Jamieson, Theydon	G. Red Poll	4155.9	4.31	179.3	277	5
P. Timms, Rusape	G. Friesland	4789.9	3.72	178.4	285	33
C. A. G. Gourlay, Umtali	G. Friesland	4468.3	3 96	176.9	297	11
E. Stanger, Rusape	G. Friesland	4431.0	3.98	176.6	292	26
K. M. Campbell, Fort Victoria	G. Friesland & Red Poll	4401.2	3.96	174.5	289	12
Miss N. Brereton, Gwelo	G. Friesland & Guernsey	4347.4	3.96	172.0	268	10
C. O. Boden, Glendale	G. Friesland	4531.5	3.79	171.6	292	20
P. A. Bowen, Salisbury	G. Red Poll &	4217.7	4.04	170.8	284	89
N. M. Hathaway, S Marandellas	G. Friesland	4865.9	3.51	170.7	255	35
J. N. MacIlwaine, Marandellas	G. Red Poll	4447 9	3.82	170.1	251	26
W. N. Gebbie, Salisbury	G. Friesland	4274.0	3.97	169.7	287	39
L. McLean, Gwelo	G. Friesland	4290.4	3.95	169.3	265	22
B.S.A. Co. Citrus Estate, Mazoe	G. Friesland	4870.0	3.48	169.3	270	18
Mrs. M. Huxham, Mazoe	G. Friesland	4742.5	3.56	169.0	298	27
L T. Tracey, Gatooma	G. Friesland	4411.2	3.75	165.6	251	7
Mrs. Y. V. Russell James, Golden Valley... ...	G. Friesland	4144.3	3.98	165.1	285	14
C. F. Mitchell P O Essexvale	G. Red Poll	3995 8	4 11	164.2	251	32
R. Thwaites, Marandellas	G. Friesland	4177.1	3.91	163.3	270	39
J H. Farmer, Bindura	G. Friesland	4062.5	4.01	163.1	272	13
S. Moore, Salisbury	G. Friesland	4363.6	3.73	162.7	272	71
Mrs. C. Harrison, Shamva	G. Friesland & Ayrshire	4025.5	4.02	162.2	265	6
C. C. Neill, Gwelo	G. Friesland & Ayrshire	4551.0	3.56	162.2	285	42
Rhodesia Corporation, Norton	G. Friesland	4698.3	3.42	161.2	276	49
N. G. Barrett, Rusape	G. Friesland	4438 4	3.62	160.5	292	39
R. A. Ballantyne, Salisbury	G. Friesland	4360.2	3.66	159.6	279	90

J. Mares, Rusape	G. Common	3903.7	4.05	158.2	292	11
G. N. Fleming, Salisbury	G. Red Poll	4329.7	3.65	158.1	297	50
H. W. Filmer, Umtali	G. Friesland & Shorthorn	3783.4	4.17	157.9	266	10
J. Cumming, Norton	G. Friesland	4030.1	3.84	154.7	270	49
B. C. Margesson, Trelawney	G. Friesland	3731.0	4.14	154.6	279	11
B. L. Miles, Banket	G. Red Poll	3983.8	3.87	154.1	274	29
H. Stobart, Arcturus	G. Red Poll	3334.9	4.47	149.1	246	12
R. M. Taunton, Norton	G. Red Poll	3412.1	4.31	147.3	243	14
Mitchell & Harvey, Odzi	G. Friesland	3564.4	4.12	146.9	277	30
H. T. Lay. Salisbury	G. Friesland	3766.3	3.83	144.4	272	25
J. H. Hornby, Hartley	G. Friesland & Shorthorn	3819.1	3.80	143.5	250	11
A. F. H. Valentine, Umtali	G. Friesland & Guernsey	3424.0	4.18	143.2	285	15
K. M. Simpson, Salisbury	G. Red Poll	3896.2	3.65	142.7	244	16
H. Coke-Norris, Umtali	G. Friesland & Red Poll	3543.4	4.01	142.2	269	27
C. E. Sparrow ,Gwelo	G. Friesland	4129.3	3.40	140.5	285	36
J C. Ross, Salisbury	G. Friesland & Ayrshire	3393.5	4.13	140.2	270	32
Salvation Army, Salisbury	G. Ayrshire	3393.5	4.09	138.9	261	33
B. Gietzmann, Gwelo	G. Friesland	3571.5	3.81	136.2	287	40
C. J. Davies, Umtali	G. Friesland & Red Poll	3144.8	4.13	129.9	276	19
G. F. Gebhardt Gwelo	G. Red Poll	2984.2	4.06	121.1	279	25
C. W. S. Ford, Sinoia	G. Ayrshire	2481.6	4.31	107.1	234	35
E. C. Holmes, Est of, Salisbury	G. Friesland	2642.4	3.85	101.8	272	8

AVERAGE FOR OFFICIAL AND SEMI-OFFICIALLY RECORDED HERDS.

Average: 5768.2 lb. Milk; 213.1 lb. B. Fat; 3.69% B. Fat; 280 Days.

Average No. Cows: 34.

Southern Rhodesia Veterinary Report.

JANUARY, 1947.

Diseases. African Coast Fever. No extensions of the disease were reported in Chipinga or Melsetter district and there was only one case on the infected farms.

Anthrax. One outbreak in Fort Victoria district with a mortality of 12 and one in Bulawayo with a mortality of 1.

Trypanosomiasis. Sixteen cases occurred on two European-owned farms in Chipinga district.

Lumpy Skin Disease. Occasional mild and isolated cases are seen in Bulawayo, Gwelo and Fort Victoria districts. Salisbury had four farms infected during the month.

Piroplasmosis and Anaplasmosis is reported from all districts —mortality is small.

Tuberculosis. Two cases in Umtali district.

Mallein Test. 49 horses and 12 mules were tested with negative results.

Tuberculin Test. 8 bulls and 2 cows were tested with negative results.

IMPORTATIONS.

Union of South Africa. 7 horses and mares, 45 geldings, 12 mules, 19 bulls (breeding), 13 cows and calves (breeding), 262 sheep (slaughter).

EXPORTATIONS.

Northern Rhodesia: 1 pig (breeding), 9 geldings, 69 donkeys, 95 goats.

Portuguese East Africa: 48 oxen (slaughter), 1 bull (breeding), 2 oxen (trek), 4 cows and calves (breeding).

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage.

Northern Rhodesia: Bacon 2,025 lbs., beef 9,096 lbs., ham 581 lbs , sausage and polony 357 lbs., fats and dripping 953 lbs., brawn 30 lbs., offal 207 lbs., pork 931 lbs.

Union of South Africa: Sausage casings 2,461 lbs., ham 11,442 lbs., offal 69 lbs.

Belgian Congo: Bacon 2,277 lbs., beef 100,494 lbs., ham 449 lbs , fats and dripping 72 lbs., offal 17,968 lbs., veal 1,173 lbs., pork 6,035 lbs., poultry 177 lbs.

Bechuanaland Protectorate: Bacon 196 lbs., beef 7,652 lbs., ham 48 lbs., sausage and polony 191 lbs., fats and dripping 186 lbs., brawn 32 lbs., offal 314 lbs.

P. D. HUSTON,
Chief Veterinary Surgeon.

SOUTHERN RHODESIA

Locust Invasion, 1932-47.

Monthly Report No. 171: February, 1947.

Red Locust: *Nomadacris septemfasciata*, Serv.

No reports of locusts in any stage of development within the Colony were received.

J. K. CHORLEY,
Chief Entomologist.

Monthly Report No. 172: March, 1947.

Red Locust: *Nomadacris septemfasciata Serv.*

No reports of locusts in any stage of development within the Colony were received.

J. K. CHORLEY,
Chief Entomologist.

THE RHODESIA
Agricultural Journal

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Editorial

Notes and Comments

FLOWER POTS FROM BANANA PLANTS.

When young banana leaf blades are held over a fire for a few minutes they become toughened and are suitable for use as a kind of wrapping paper. The petiole which is very fibrous can be used for tying while wide strips make excellent containers for such things as chillies, groundnuts and cotton.

In the Botanic Gardens at Entebbe "flower pots" were made from the leaf blades. Wooden posts were sunk in the ground and the leaves wound round to form the shape of the pot; natives made about a hundred of these a day. The pots may be made in any size and will contain a plant for six months or more. The plants are set out without removing from the pot.—("Gardeners' Chronicle, March 29, 1947.)

REVIEW OF ROTHAMSTED EXPERIMENTAL STATION, HARPENDEN.

Report for the War Years 1939-1945. (Copies at 5/- each obtainable from the Secretary. Foreign postage extra.)

This comprehensive report deals with the work carried out by the various departments during the war years. A list of the available publications of this Station is included. This valuable publication should be in the possession of all who are interested in agricultural research.

Although much of the work at Rothamsted had to be curtailed during the war years the field work of the more important experiments, especially long term ones, was continued. Problems on soil work was mostly connected with the food production campaign. A war time fertiliser policy, based on results of all recorded field experiments during the century in Britain, was formulated. Organic manures were studied. These included farmyard manure, sewage sludge, straw, etc. Results from stacked young bracken were excellent, but sewage sludge supplied little beyond nitrogen and phosphate. A new phosphate fertiliser—silico fertiliser—was developed and found to compare favourably with superphosphate for swedes and for re-seeding in wetter areas. Considerable work was done on trace elements so that it is now possible to recognise deficiencies of manganese, boron, magnesium and potassium and to distinguish them from each other and from chlorosis due to virus and fungus diseases.

A study of the daily recordings of the Rothamsted drain gauges from 1871 to 1940 and of continuous readings from 1925 have afforded valuable information about the rate of evaporation from bare soil. It has been shown that there is a depression of crop yield due to weed competition, but that inter-raw cultivation does not reduce direct evaporation from the soil.

Efforts are being made to improve the clover content of pastures by inoculation with effective strain of nodule bacteria. It was found that 2:4 dichlorphenoxy acetic acid is a successful weed killer for use in cereal crops. A new direct method of counting bacterial cells and estimating the quantity of mycelium in the soil by direct microscopical examination has greatly facilitated the study of micro population of field soils. A new method for determining the numbers of protozoa in the soil has also been found.

In Plant Pathology attention has been focussed on diseases of potatoes, sugar beet and cereals. Much has been done on viruses and fungi, and the work on the former has been facilitated by the use of an ultra-centrifuge and electron microscope. New viruses have been isolated and identified as crystalline nucleo proteins and their physical, chemical and serological properties tested. From these experiments it is now possible to develop a rapid method of diagnosis for the commoner virus diseases. In connection with this virus work much has been done on the intricate relationship between viruses and their vectors, while in the field, the spread of virus diseases in potato and sugar beet crops has been carefully studied.

In connection with fungus diseases work has been carried out in particular on *Cercosporella herpotrichoides* on wheat and on *Phytophthora infestans* on stored potatoes. Other fungi studied included *Rhizoctonia solani*, *Verticillium albo-atrum*, *Ophiobolus graminis*, etc.

In the Entomological Department the work came under three main headings: (1) Causes of insect outbreaks, (2) Work on particular pests—not necessarily insects, e.g., slugs, wireworms and gall midges (3) Investigations on earthworms and their relation to soil formation and fertility.

Climatic conditions at Rothamsted are such that temperature is the most important factor during the winter months and rainfall in the summer months for determining insect abundance.

Plants which natives use as fish poisons were examined to ascertain their value as insecticides, e.g., Derris, Lonchocarpus, and Tephrosia, while considerable work was done on Pyrethrum. D.D.T. was found to control cabbage caterpillars and mustard beetles completely, but red spider and certain aphides remained resistant. The effect of toxicity of D.D.T. on beneficial insects, e.g., bees, both by contact and as a stomach poison, was found to be less serious than was at first supposed. Cucumbers and vegetable marrows sprayed with D.D.T. suffered little damage.

In the Statistical Department many valuable compilations were made, including a summary of fertiliser trials and an investigation of the effect of changes in level of feeding of dairy cows on milk production. This latter investigation showed that an over-stringent rationing resulting from shortage of foods might lead to a serious reduction in milk supply without any equivalent saving in food. A start has been made on the study of agronomic and economic value of ley farming compared with other farming systems.

In the Botany Section work has been continued on the reduction of the weed seed population of arable land by fallowing. The routine fallowing of one section per year has been justified, as it has been proved that the weed seed population has decreased during the 15 years that the system has been operated. Poppy has decreased steadily.

It is hoped to publish at a later date the analytical and observational data from the botanical analyses of the herbage of Park Grass and High Field. This section of study had to be curtailed during the war.

Tetram.

Tetrachlorethylene emulsion (Tetram) for the treatment of Hookworm in cattle and sheep is again available and may be obtained from the Director of Veterinary Research, P.O. Box 657, Salisbury, at 30/- per gallon, cash with order.

This remedy also kills wireworm, bankrupt worm, brown stomach worm, and tape-worm of sheep, and wireworm and bankrupt worm of cattle.

One gallon is sufficient to treat 600 adult sheep or 50 adult cattle once, but at least two treatments at intervals of 10-14 days are advised.

Directions for diluting the Tetram with water and the dosages for cattle and sheep are supplied on request with the remedy.

Quarter Evil.

By D. A. LAWRENCE, Director of Veterinary Research, Southern Rhodesia.

Synonyms. Black Quarter, Black Leg, Quarter Ill, Sponssiekte, Gangrenous Emphysema.

Definitions. Quarter Evil is an acute, septicaemic, infectious, but not contagious, disease affecting chiefly young cattle, but also sometimes sheep, goats and swine, which is characterised by fever and the development of localised spongy, creptitating swelling in the large muscle groups and which in the vast majority of cases terminates fatally.

Cause. Being an infectious disease, i.e., one caused by specific infective agent, Quarter Evil can only develop as a result of infection with its specific causal germ, a bacillus known as Clostridium chauvei. This bacillus is one of the gas-gangrene group and occurs throughout the world, no country being completely free. In certain countries and in certain localities it is more prevalent than in others.

Clostridium chauvei is a spore-forming organism. These spores or seeds are extremely resistant to heat, cold, dessication, putrefaction or disinfection, and can develop and multiply as saprophytes in the soil, thus persisting in it almost indefinitely. They have been proved to survive in dry vleis for 18 years, and are known to persist for at least 6 months in decomposing carcases. Where Quarter Evil has once occurred, therefore, its reappearance is to be expected, and even where it has never been known to occur the possible presence of the organisms in the soil should be anticipated.

Animals Susceptible. Quarter Evil is most common in young cattle between the ages of 6 months and 3 years, young calves and adult cattle rarely becoming infected. In this age-group it is not uncommon for the best "doers", i.e., the fattest and thriftiest, to be attacked first, usually those between 9 months, and 18-24 months old.

Sheep are also susceptible, but in these animals the disease usually results from wound infection taking place during shearing,

docking, or castration. Goats, and even still more rarely pigs have also been known to contract the disease.

Method of Infection. Infection may be regarded as coming from the soil, some localities, even individual paddocks, being more dangerous than others. For infection to develop it is essential that the Quarter Evil germs gain entry into the body of a susceptible animal. This may occur through wounds or through eating and drinking. In the case of cattle the usual route of infection is "peros," i.e., through ingestion of infected material, but many authorities maintain that even in such a case the organisms really only gain entry to the body via wounds or abrasions in the mouth or digestive tract. The shedding or eruption of teeth would appear to furnish ideal conditions for infection by this route. In sheep the disease normally occurs as a result of wound infection.

Symptoms. The disease may occur sporadically or as an outbreak. What usually happens is that an isolated single case occurs, or a few cases together, and that this is then rapidly succeeded by a number of cases in the form of an outbreak.

The incubation period, i.e., the time that elapses between the germs entering the body and the appearance of symptoms, is usually 2 days, the limits recorded being 1-5 days. Owing to the rapid course of the disease, 24-48 hours, however, symptoms are rarely noted, the first intimation being that the animal is dead.

The affected animal usually shows lameness or stiffness in one or both hind- or fore-legs. It is dull, lags away from the herd, ceases to feed or chew the cud, looks generally depressed and sick and runs a high temperature which may drop to below normal shortly before death. On examination of the affected limb one notes swelling of the thick muscular part, e.g., thigh, rump, loin, or shoulder which is hot, painful, and sounds hollow when tapped with the finger and gives a crackling or crepitant sound when manipulated, due to the accumulation of gas under the skin and in the muscle.

Later this swelling becomes increased in size, cold, and painless, the skin covering it often becoming parchment-like; sometimes the hair and superficial skin covering falls off in patches or can be rubbed off easily, and droplets of dark, watery, blood-stained fluid exude. During the progress of the disease, respirations become rapid and painful and symptoms of abdominal pain (colic) may occur. Death almost invariably follows within 24-28 hours from the onset of symptoms, recoveries being extremely rare.

Post-mortem Changes. As one would expect owing to the rapid course of the disease, the post-mortem changes are far more commonly observed than the symptoms. Putrefaction of the carcase is not unduly rapid, though it is usual for the abdomen to become blown-up fairly soon after death. There are no strikingly characteristic changes in the general organs as distinct from the changes in the affected muscles. The blood is dark and clots normally. There is usually no enlargement of the spleen, but occasionally this organ is swollen and gassy. The lymph glands are slightly enlarged and congested, especially near the site of infection, and the body cavities (chest and abdomen) frequently contain blood-stained fluid. The carcase emits a sour as distinct from a putrid smell. The characteristic and often the only recognisable lesions are those of the affected quarter, usually the thick muscular upper part of the hind-leg, the rump, the loin, the thick shoulder muscles or rarely the neck. Even before opening, the swelling is noticeable; the skin is hard and parchment-like or moist and partially hairless and exuding droplets of blood-stained fluid. On handling this part one gets the crackling, gassy sound as described under symptoms. On cutting into this lesion one notes the presence under the skin of brown or dark red gassy fluid.

The affected flesh is dark red, sometimes black-streaked or almost black, spongy and full of gas bubbles, the muscle fibres in the centre of the lesion being dry and separated by gas-bubbles. From this cut surface exudes a pronounced sour smell resembling rancid butter.

Diagnosis. Owing to the rapid course of the disease it is rarely diagnosed in the living animal, but where there is pronounced illness, combined with lameness and gassy swelling of one quarter in a young thrifty animal a tentative diagnosis of Quarter Evil can be made pending death and post-mortem confirmation.

On post-mortem examination diagnosis is rarely difficult—the age and type of animal, coupled with quick death and the presence in an otherwise comparatively normal carcase of a swollen, gassy, darkened large muscle group which is spongy and rancid-smelling is typical. For purposes of confirmation it is essential that smears should be made from the juices expressed from this affected quarter—the Quarter Evil bacilli cannot normally be detected in ordinary blood smears nor with any degree of certainty in spleen smears. Blood and spleen smears in addition should, however, be submitted for the identification of other diseases

Confusion in diagnosing Quarter Evil is most likely to arise as a result of decomposition but in a putrid carcase, although there may be pronounced gassy swellings these are not localised to one particular large muscle group but are more generalised; also the smell is a putrid, not just a rancid one. If one notes lesions in both hind- and fore-quarters and other parts of the body then the condition is almost certainly not Quarter Evil.

Another condition sometimes confused with Quarter Evil is snake-bite—in this one may get the blood-stained fluid exuding from a swelling with darkening of the underlying muscles, but gassiness is absent, as is also the rancid smell.

There is another bacterial disease, Malignant oedema, which behaves similarly to, and produces lesions very closely resembling those of Quarter Evil. The bacilli are also so closely allied to Clostridium chauvei that it is not possible to differentiate them even microscopically in smears, the only certain means of doing so being by growing them in bacteriological media. Where there is reason to believe that cases that look like Quarter Evil are not in fact due to Quarter Evil, e.g., deaths in old cattle or in cattle that have been regularly vaccinated, a piece of the affected muscle should be cleanly cut out and sent to the laboratory, either in the fresh state preserved in equal parts of glycerine and water, or in a dry state in the form of "biltong."

Treatment. Almost every animal that contracts Quarter Evil dies, and there is no known treatment to stop the disease from running its usual fatal course when once it has developed, so much so that when one hears of a case of Quarter Evil being "cured" one immediately becomes very sceptical as to whether it was a case of this disease at all.

Prevention. For Quarter Evil to occur two things are indispensible, viz., susceptible animals and causal germs. Elimination of one or other of these factors will prevent the development of the disease.

To eliminate the germs completely is utterly impracticable—they are very wide-spread in nature and very resistant in their spore form to all influences. Nevertheless, some steps can be taken against the germs when they are concentrated in their countless billions in the sick or dead animal. As far as the sick animal is concerned it should, in those rare cases where it is seen, be confined so that it does not go on distributing germs and contaminating the pastures. With regard to the carcase, it should be burnt or deeply buried, preferably in a coating of quicklime, together with any dung or discharges near it. If not dealt with in this way there is grave danger of natives carting infected meat about, or even of jackals and vultures spreading infection.

Apart from these steps, however, one can do nothing against the germs themselves, so the most important preventive measure is concerned with the susceptible animal. The way to deal with this is to render it non-susceptible, i.e., immune, and fortunately

this can be safely, easily, and cheaply effected by the use of preventive vaccines.

Immunity conferred by vaccines of this type is normally durable for a year, and as the most susceptible age of calves is from about 9 months to two years a single inoculation at the age of 9-12 months may be expected to suffice for life—in fact, it is primarily on these grounds that certain proprietary vaccines are claimed to confer life immunity as a result of a single injection. While the adoption of such a policy of inoculation serves fairly well in practice in most cases, it cannot be regarded as providing a complete safeguard.

The safest policy is to inoculate all cattle annually up to the age of 3 years, starting when they are 6-9 months old. If this policy is conscientiously practised deaths from Quarter Evil should never occur.

In the event of an outbreak occurring, or on known badly infected farms, where the above system of annual vaccination has not been practised at all or only for a short time previously, it is advisable to inoculate stock of all ages, including adult cattle and calves even younger than 6 months of age. With regard to these young calves, however, it must be realised that the very young do not develop a durable immunity and that they should therefore be re-inoculated within 6-9 months. The cost is small, 3d. per dose, the vaccine cannot do any harm, and to save the life of possibly even only one beast in a herd through timely use of the vaccine fully justifies this recommendation, on purely economic grounds.

As already mentioned, the vaccine is a preventive and it should be used as such, i.e., to prevent the disease occurring. Many people still believe in deferring inoculation in the hopes that they will not get the disease, and therefore wait until a case, usually several cases, develops before taking the necessary precautions. Such an attitude cannot be too strongly deprecated. In spite of repeatedly being advised to inoculate with Quarter Evil vaccine as a routine annual procedure, there will still be stock-owners who omit this simple precautionary measure, and to these a special further plea is made not to neglect to establish diagnosis of the first case. They should not accept the herd-boy's opinion that a calf has died of snake-bite but should personally make a post-mortem examination to determine as accurately as possible what caused the death. If Quarter Evil were responsible, inoculation can then be undertaken immediately, thus preventing further unnecessary deaths. This first case, however, is likely to be followed by several more in quick succession and by others even up to a fortnight after inoculation, as it takes 10-14 days for the vaccine to establish immunity.

Quarter Evil vaccine is supplied by the Veterinary Research Department at 3d. per dose, in quantities of 10 doses or multiples of ten, and is available throughout the year. It is a "dead" vaccine and therefore completely safe to use. It is also simple to use, the dose being 2½ c.c. as an injection under the skin.

The Eastern Districts Senecio Problem.

By H. WILD, Ph.D., D.I.C.

I. **Summary.**

(a) Introduction: The importance of the problem.

(b) The botanical identity of the plant, its identification and botanical description.

(c) General description of the plant.

(d) Phytogeography or geographical distribution of the plant with map.

(e) Factors affecting the density of infestations, e.g., veld fires, overgrazing, grass cover, etc.

(f) Description of experiments on chemical methods of control.

(g) Conclusions: An estimate of the value of possible cultural control methods.

(h) Bibliography.

II. **Introduction.**

In August, 1945, the writer was asked to investigate from a Botanical point of view a *Senecio* which is very frequent throughout the Eastern Districts, and which for several years has been strongly suspected of poisoning cattle. The view that *Senecio* poisoning in the Eastern Districts is of importance to cattle farmers has been strongly stressed by H. K. Hesketh (1), the District Veterinary Surgeon in Umtali, and the need for research into the problem discussed by one of the farmers intimately concerned, I. Wilson (5). The incidence of poisoning, however, in the field is a very difficult matter to assess owing to the fact that deaths from *Senecio* poisoning may be masked by other diseases, and also by poverty in the cattle concerned, as the most likely period for them to be affected is in the spring, when the veld is at its poorest and the young *Senecio* plants are just beginning to appear, and the cattle are in their poorest condition in any case. In addition, only rarely is the *Senecio* seen to be grazed, the cattle normally having a natural antipathy to the plant. *Senecio* poisoning in the Union of South Africa, however, is well known, and a great deal has been done on the problem by Steyn (2) and (3) and his co-workers at the Onderstepoort Laboratories, in the Transvaal. These workers, however, found that toxicity varied with the particular *Senecio* species concerned; some species in fact being quite harmless. It was therefore of the greatest importance that an accurate botanical identification be given of the Rhodesian plant, in order to correlate it if possible with the work already done in the Union. Having satisfactorily identified the plant, and

so assisted in deciding on its importance from a toxic point of view it was hoped that the botanical section would also be able to advise in the best method of its eradication.

III. The Botanical Identity of the Plant.

Unfortunately, the identification of the plant was particularly difficult, as it belonged to a group of *Senecios* always known collectively in the past as *Senecio latifolius D.C.* and as such had always been identified. This composite group, however, has now been split by botanists in the Union, into a number of species closely related botanically but showing distinct differences. Accompanying these botanical differences there are also differences in toxicity, and so it became essential to discover in what species of the "*Latifolius*" group the plant should be placed. In February, 1944, therefore, specimens of the plant (G.H. 9433 and 9420) were sent to the National Herbarium, Pretoria, for their asistance in naming them, but owing to the fact that the division of the group was still uncertain, only the general identification ". . . . species allied to *S. latifolius D.C.*" was given. By January, 1947, a much wider range of gatherings of the Eastern Districts *Senecio*, and related forms had been got together, and the opportunity of a visit to the National Herbarium, Pretoria, was taken by the writer, to compare our material with that in their herbarium. It then became evident that these specimens—G.H. Nos. 13568 from the Vumba, 13469 from Melsetter, 13450 from Melsetter, 13207 from Umtali, and 8612 from Inyanga, all agreed with specimens in the National Herbarium, Pretoria, named *Senecio sceleratus* Schweikerdt,* one of the new species belonging to the "Latifolius group," and this identificatian has since been checked and confirmed by Miss Kies, of the National Herbarium.

*BOTANICAL DESCRIPTION.

Senecio Sceleratus Schweickerdt sp. Nov. related to S. glaberrimus D.C. but differs in that there are more leaves, the upper leaves are larger, the leaf margins are dentate and the nerves prominently anastomose.

Senecio Sceleratus Schweick sp. Nov. with many leaves, the upper largest, margins striate, straight or undulating, generally simple with an apical widely spreading, many-headed corymb.

Internodes 2-7 cms. long.

Leaves 8-10 cauline, about 10 cm. long and 3 cm. wide, coriaceous, elliptical or lanceolate, apex acute, margins small-toothed, veins ascending, intermedite veins prominently anastomosing. Lower leaves petiolate and deciduous, bases only slightly auriculate. Upper leaves about 1.5 cms. long and 0.5 cms. wide, gradually becoming smaller and sessile upwards, bases auriculate and somewhat decurrent and cordate-amplexicaul.

Bracts about 2-3 mm. long, lanceolate.

Corymb fastigiate, many-headed and widely spaced.

Peduncles about 2.5 cm. long with scales below.

Capitula sparingly calycelled, campanulate. Involucral bracts 8-9 equal or sub-equal, linear or oblong, obtuse or sub-acute, margins widely or narrowly membranaceous, ciliate in the upper third.

Ligulate Flowers 4-5, yellow, always 4-nerved, lower lip protruding and paved with minute hairs, style branches glabrous, achenes striate and glabrous.

Disc Flowers 12-17, yellow, lower part of tube cylindrical, upper part dilated, branches of the style penicillate at the apex, achenes striate and glabrous.

Pappus of copious white bristles.

General Description of the Plant. *Senecio Sceleratus* in the Eastern Districts is a strongly-growing perennial, usually appearing as clusters of unbranched shoots arising from a dense mass of roots beneath the ground surface. The roots are usually about $\frac{1}{8}$ inch in diameter, and form a solid mass about 9 inches in diameter. The upright stems are somewhat woolly at the base, about ground level, and carry smooth, rather tough stem leaves. The young shoots usually appear in early spring about August, and in a month or so attain a height of about 2 feet, and carry many heads of small, yellow flowers, which on maturing soon produce masses of typical composite achenes or seeds, each windborne by means of a pappus or crown of white hairs (cf. photograph).

This identification is of considerable importance, as Steyn (4) in "The Toxicology of Plants in South Africa" states that:—"*Senecio Sceleratus* is by far the most toxic species of *Senecio* encountered in South Africa."

IV. Phytogeography or Geographical Distribution of the Plant.

In Rhodesia it appears to be restricted to altitudes of about 4,000 feet and over in the Eastern Districts, following a long belt from as far north as Inyanga down to Melsetter, the following being the specimens listed in the Government Herbarium, Salisbury:—

Inyanga district,	5,000 feet	J. C. Hopkins	in G.H. No.	8612
Umtali district,	5,000 feet	P. A. Cremer	in G.H. No.	13207
,, ,, Vumba,	5,000 feet	H. Wild	in G.H. No.	13568
Melsetter district,	5,000 feet	J. C. Hopkins	in G.H. No.	13450
,, ,,	5,000 feet	J. C. Hopkins	in G.H. No.	13469
Stapleford	5,000 feet	H. B. Gilliland	No.	447
,,	5,000 feet	H. B. Gilliland	No.	396

Passing south with a gap in the valleys of the Limpopo and Sabi it next occurs in the Northern Transvaal at the higher altitudes, the following being a list of specimens supplied by the National Herbarium, Pretoria, of specimens in their possession:—

Lydenburg District.

Lydenburg Town: Burtt-Davy		416
Alt. 5,000 feet	,, ,, ...	7261

Pietersburg District.

Alt. 2,375 feet.	Tzaneen: Phillips...	3265
	: Pole Evans... ... ... H.	15820
	Boschkopje: Govt. Vet. Off. O.P.	16200 D
	Haenertsburg: ,, ,, ,,	8341
	Pietersburg: ,, ,, ,,	6252

Alt 3,500 feet.	Tzaneen, Malopene, Lam & Meeuse	5030
	The Downs; Lance	26450
Alt. 5,000 feet.	Mountain Hawe; Cunliffe	—
Alt. 5,058 feet.	Duiwelskloof: Galpin	11407
	Haenertsburg: Pole Evans	1772

(See map).

The area of distribution is a very compact one, being interrupted only by the low-lying Sabi and Limpopo valleys and the localities in the Northern Transvaal, besides being geographically contiguous with those in Rhodesia, show a marked similarity in altitude and type of country.

In the remainder of Rhodesia, particularly the Salisbury area, *Senecio* of the *Latifolius* group are also frequent, some of these, e.g., G.H. No. 13586, 16161 and 13623 from Salisbury, G.H. No. 8511 and Rattray 308 from Marandellas, G.H. No. 8282 from Bulawayo, are Senecio sp. near *Senecio retrorsus D.C.*, another poisonous species occurring in the Union; but even if this plant is poisonous it is not such a dominant feature of the veld as *Senecio sceleratus* in the Eastern Districts and it is unlikely to be so important as a toxic plant. In addition, a third plant, H. Wild in G.H. No. 13622 found in, or near, vleis in the Salisbury area closely simulates *Senecio sceleratus* and is probably a new species; it is, however, too infrequent to be of importance as a danger to cattle.

V. Factors Affecting the Density of *Senecio sceleratus* Infestations.

Senecio sceleratus is normally found in open grassland at heights above 4,000 feet as previously stated, unlike the *Senecio sp. nr. retrorsus D.C.*, most frequent in the Salisbury area, which is more typically found in open "Msasa" (Brachystegia Randii Bak.f.) savannah. As, however, a number of largely man-made ecological factors such as burning the veld, grazing, etc., are considered by many of the farmers, and others concerned, to influence the density of the plant, a number of observations have been made in the last two years to find whether such is the case, as this might give a lead to possible methods of control of the pest. This work was handicapped by the infrequency and the brief nature of visits to affected districts, owing to the pressure of other work, but sufficient evidence has been collected to indicate future methods of approach to the problem.

(a) **The Effect of Veld Fires.** It has often been observed that infestations of the *Senecio* appear to be denser and more vigorous following burning of the veld, and in order to test the evidence for this belief, in August, 1945 transect counts were made across the edge of burnt areas, i.e., a line was strung on the ground so as to lie partly in a burnt area and partly in an unburnt portion of veld lying alongside, and then the number of plants counted at 1 yard intervals in both burnt and unburnt areas. In all cases there was a greater number of shoots in the

burnt area, although they were only rarely completely absent in the unburnt parts, and in addition the height of plants in the unburnt area was in general greater. (See fig. 1.)

A likely reason for this increase is that in unburnt veld the *Senecio* is in competition for light with the surrounding grasses, but that when burnt off the *Senecio*, because of its extraordinarily large root-system filled with reserve food-material is enabled to get a start over the grasses, and send up young shoots and leaves which in turn manufacture more food reserves, which pass down into the root once more. With successive burns the process is repeated, and each time the *Senecio* takes a stronger hold on the veld.

(b) **The Effect of the Physical Disturbance of the Veld.** It frequently occurs that along roadsides during the process of levelling, soil is thrown from the roadway into ridges parallel with the road, ditches are also dug to prevent flooding, and when this occurs in *Senecio* areas, it can often be noticed that the occurrence of the plant greatly increases on the disturbed soil. Diagramatic representation of counts showing this effect can be seen in fig. 2. Similarly, if firebreaks are made by removing surface vegetation rather than by burning, the same effect can be seen. In other words, disturbance of the soil or removal of surface vegetation is another means by which the number of *Senecio* plants is increased. A possible explanation is that breaking up the root-systems stimulates the production of new shoots, as occurs with a number of perennials of this type. In addition, of course, other surface vegetation is absent for a time in these cases and the result of lack of competition as is produced by burning will also encourage the *Senecio*.

(c) **The Effect of Competition from Grasses.** In the Eastern Districts many farmers of recent years have made a practice of planting introduced grasses which have proved to be higher yielding than the indigenous grasses of the area. The most frequently seen examples are *Kikuyu* (*Pennisetum clandestinum Crow*) and *Paspalum* (*Paspalum notatum Flugge*). Both these grasses produce a good sward under favourable conditions, and so offer strong competition to other constituents of the veld. A number of transects were made in paddocks where these grasses were established over part of the area, but then passed into a sward of indigenous grasses (see fig. 3). The results were most marked. *Kikuyu* was invariably successful, in a good stand, of crowding out all *Senecio* plants. *Paspalum* was only partially successful, but in general carried far fewer *Senecio* plants than the surrounding sward of indigenous grasses, which in the examples shown in the diagrams, was principally composed of *Sporobolus pyramidalis Beauv.*

All the paddocks investigated were on fairly steep slopes and in each case the *Senecio* increased towards the foot of the slopes, but this was probably due to the fact that the planted grasses seemed to establish themselves most readily at the top of the slopes.

Senecio Sceleratus Schweickerdt.

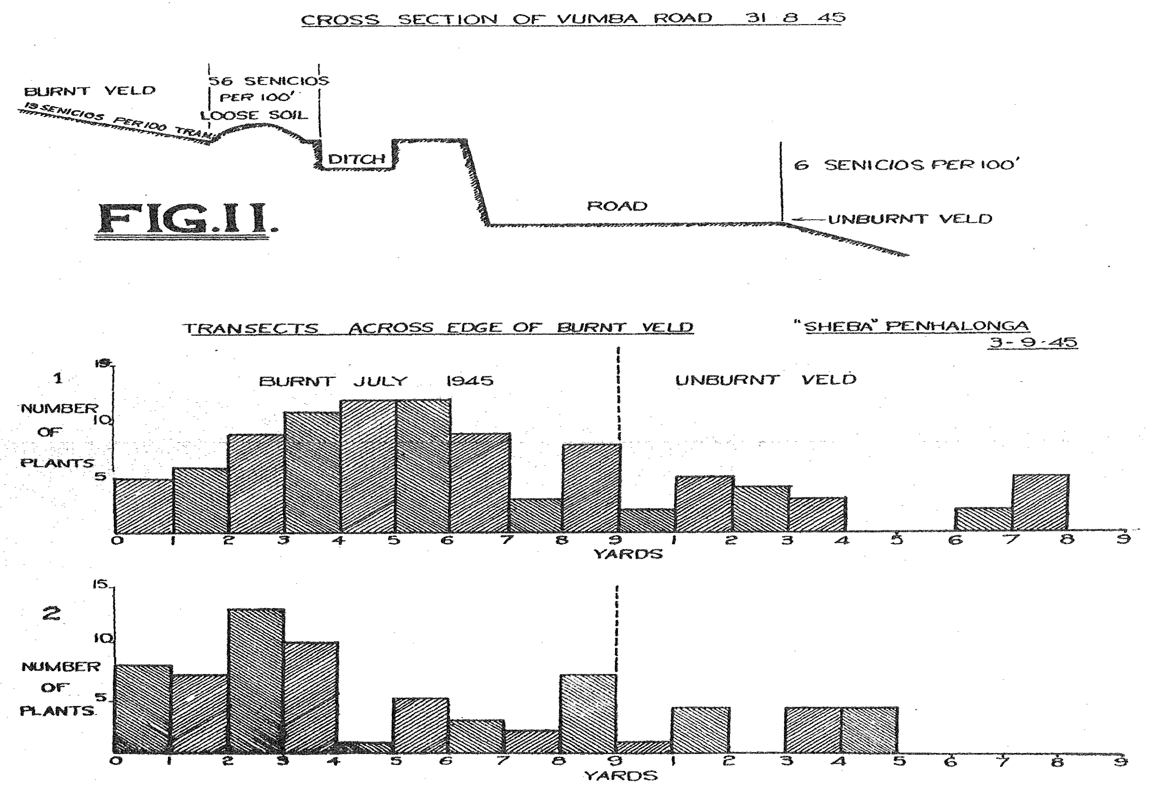

CROSS SECTION OF VUMBA ROAD 31 8 45
BURNT VELD
19 SENICIOS PER 100 TRAN
56 SENICIOS PER 100'
LOOSE SOIL
DITCH
ROAD
6 SENICIOS PER 100'
UNBURNT VELD
TRANSECTS ACROSS EDGE OF BURNT VELD
"SHEBA" PENHALONGA
3-9-45
1
NUMBER OF PLANTS
BURNT JULY 1945
UNBURNT VELD
YARDS
2
NUMBER OF PLANTS
YARDS

FIG.II.

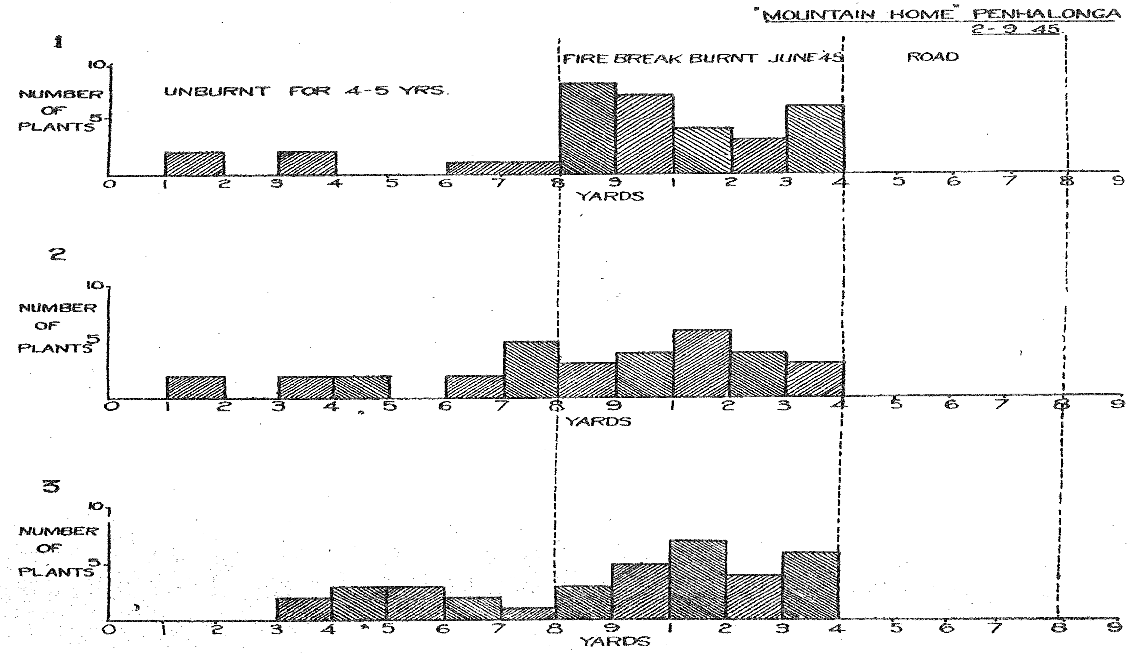


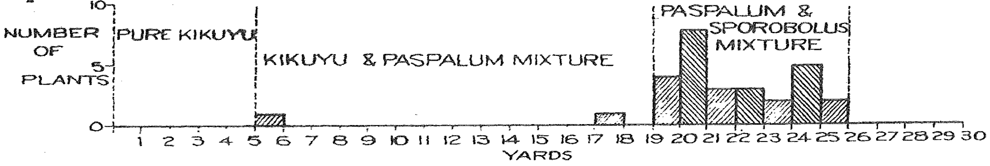
FIG. I.

D.P.HARROLD IRRIGATION DEPT
SALISBURY MAY 47

"INODZI". PENHALONGA.

TRANSECTS ACROSS PADDOCKS PLANTED WITH KIKUYU AND PASPALUM

1



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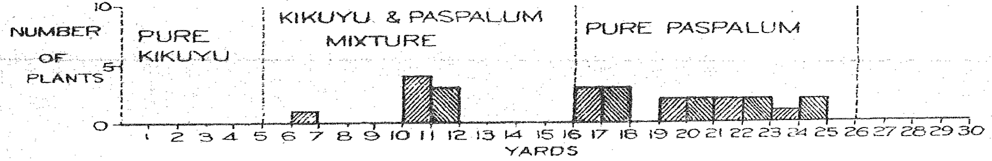

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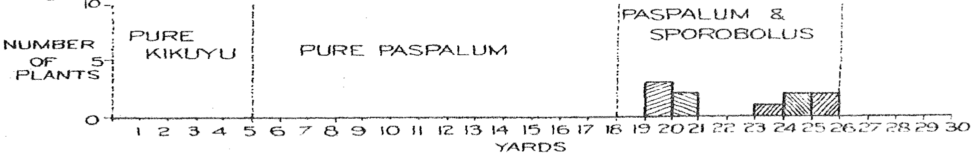


"MOUNTAIN HOME". PENHALONGA.

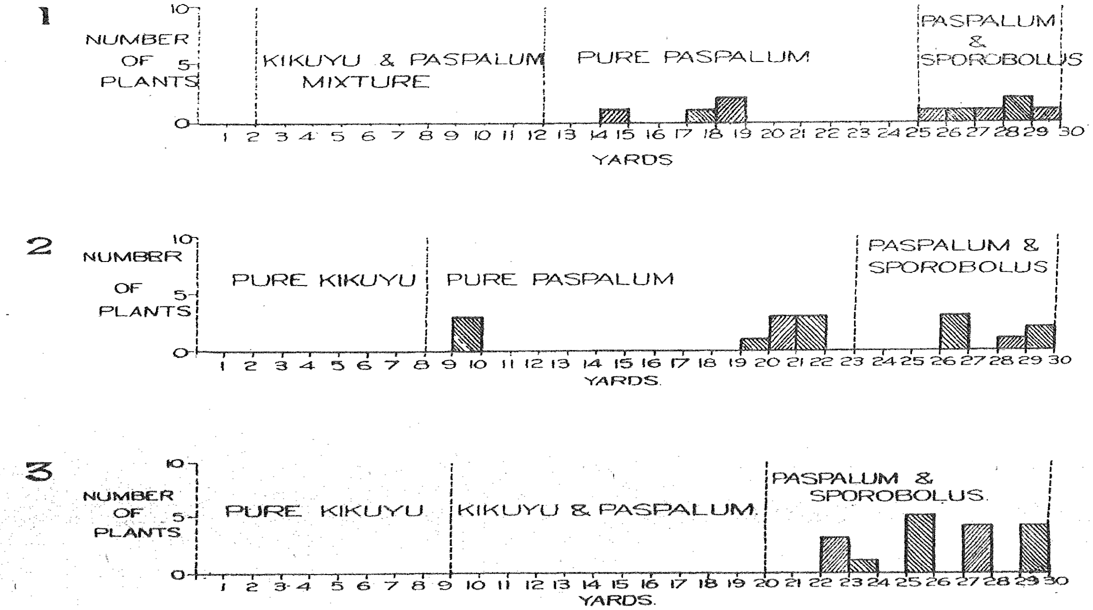


FIG. 3.

D.P. HARROLD. IRRIGATION DEPT
SALISBURY MAY 1947

"MOUNTAIN HOME".

2-9-45.

TRANSECT ACROSS SALT-LICK.

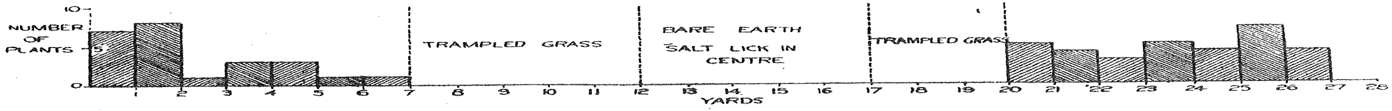
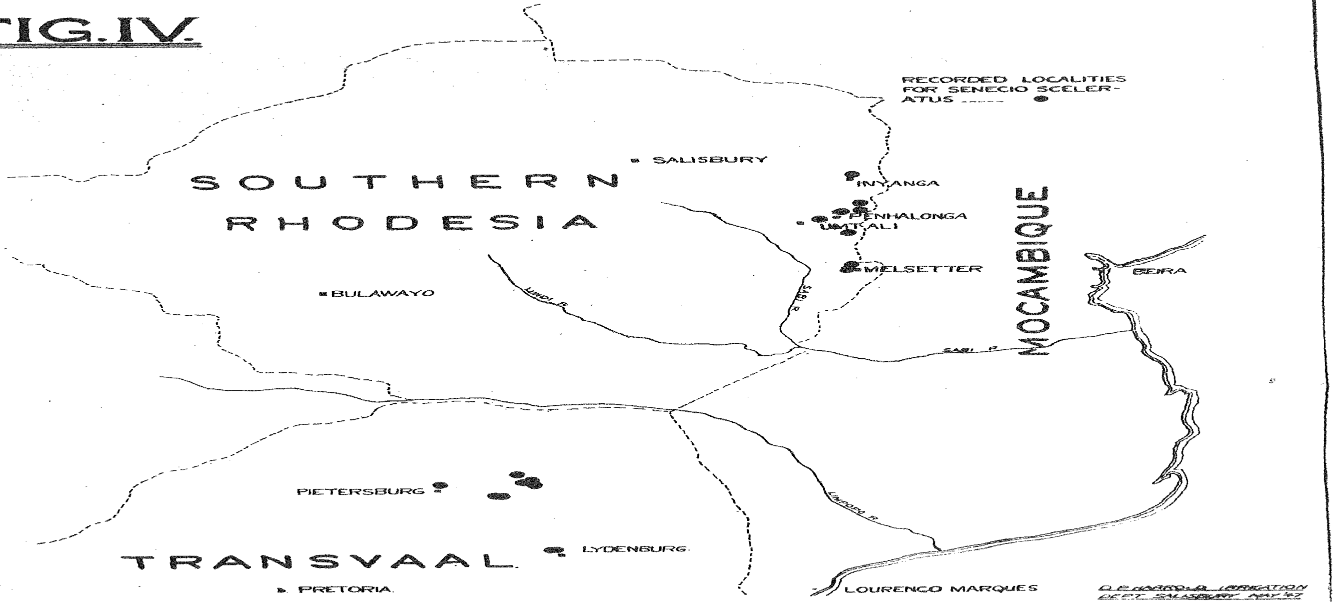


FIG. IV.



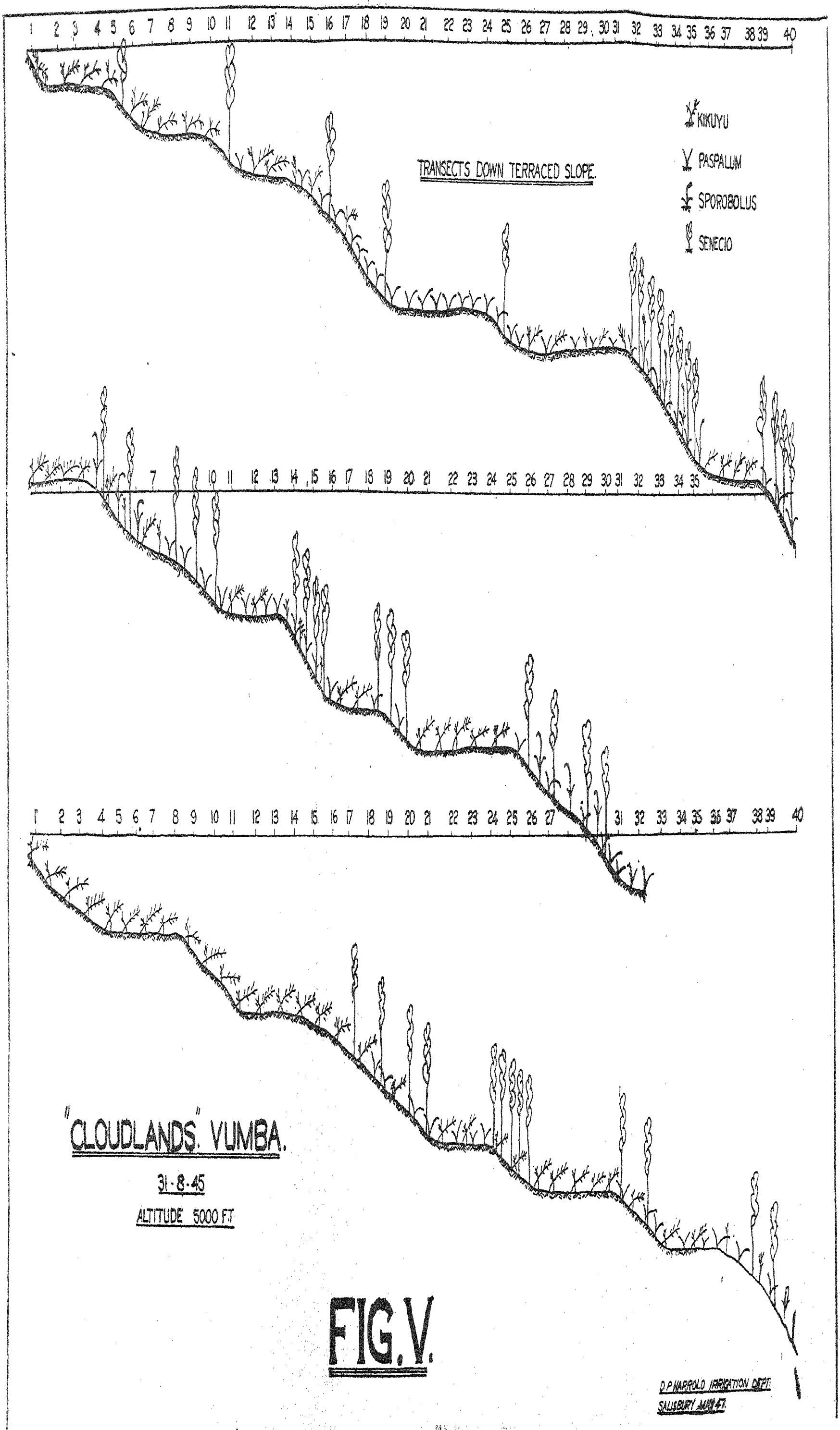

TRANSECTS DOWN TERRACED SLOPE.
KIKUYU
PASPALUM
SPOROBOLUS
SENECIO
"CLOUDLANDS" VUMBA.
31-8-45
ALTITUDE 5000 FT
D.P. HARROLD IRRIGATION DEPT.
SALISBURY MAY 47.

FIG. V.

That the indigenous grasses themselves offer differential competition to the *Senecio* was observed in company with Mr. J. M. Rattray, of Grasslands Experimental Station, Marandellas, at Inyanga in October, 1946. The grass communities on most of the slopes at about 6,500 feet having a northerly aspect are largely *Hyparrhenia* spp., *Themeda triandra Forsk* and *Rhyncelytrum repens* (Wild.) C. E. Hubbard. These usually carry quite very heavy infestations, but the southerly slopes of Mt. Inyangani, on the contrary, carry almost pure stands of a *Tristachya* sp. which was not identified at the time as it was not in flower. Here *Senecio* together with most of the geophytes common in the Inyanga district were entirely absent, whilst along the roadside where *Tristachya* was absent and the veld disturbed, *Senecio* was abundant.

(d) **The Effect of Grazing and Trampling.** The grazing and trampling of the veld is also an important factor in the balance of grasses and accompanying vegetation, and it is common knowledge that over-grazing will weaken the grasses and afterwards encourage other useless or harmful plants at the expense of the grass cover. Under-grazing, however, may have much the same result, and observations were made on this factor, in connection with the density of *Senecio*.

An interesting example is that illustrated in fig. 4, which is of a transect taken across an area at the centre of which was a salt lick at Penhalonga. The area immediately surrounding the lick was devoid of all vegetation, but around this was an area which was still able to maintain a close sward of grass which carried no *Senecio*. Further away still, both *Senecio* and grasses were present. The grass in other words, was able to stand up to more intensive trampling and grazing than the *Senecio*.

Another example of much the same kind of thing is shown in fig. 5, which is on the Vumba. It is a sketch diagram of a steeply-sloping hillside terraced by cattle walking back and forwards along it whilst grazing. The hillside carried a fairly heavy infestation of *Senecio*, but it will be seen that it was completely absent from the more or less level cattle-tracks, and frequent in the slopes between. The grasses, however, were at their best on the trampled and grazed tracks, the slopes in places were quite bare of grasses, and showed traces of incipient erosion.

VI. Experiments on Chemical Methods of Control.

(a) **Selective Weed-killers.** Since the *Senecio* is a strongly-growing perennial, it seemed unlikely that any selective weed-killer would provide any effective control. This was shown by an experiment carried out at Penhalonga on 4th September, 1945. The following selective weed-killers, together with the addition in each case of a casein spreader to enable the sprays to stick to the rather glaucous leaves, were tried:—

(1) 4% copper sulphate.

(2) 8% copper sulphate.

(3) 2% di-nitro-ortho-cresol paste as supplied commercially.

(4) 1% di-nitro-ortho-cresol paste as supplied commercially.

(5) A zinc waste wash from a nearby gold mine, with approx. 6% zinc sulphate and 2% sulphuric acid.

The experiment was laid out as a randomised block experiment with controls, and as was anticipated, none of the treatments achieved even a complete kill of the aerial parts of the plants.

(b) **Non-Selective Weed-killers.** On 8th December, 1945, a randomised block experiment consisting of 20 plots, each 1/100th of an acre and containing about 200 *Senecio* shoots were laid out, and the following treatments applied:—

(1) Sodium chlorate.

(2) Borax.

(3) Sodium chloride (cattle salt).

(4) Control.

In each case the weed-killers were applied in chrystalline form by pulling up the shoots of *Senecio* and placing a pinch of the substance on each stem base thus exposed. This method was used as the simplest that could be devised for such a small experiment. Approximately one year later, i.e., on 2nd November, 1946, the experiment was examined, and although a complete kill had not been obtained with any treatment, the sodium chlorate had reduced the number of visible shoots to about 25%. The borax and cattle salt had also brought about a reduction in stand, but not sufficient to be of real value.

VII. Conclusions.

The critical identification of the Eastern Districts *Senecio* as *Senecio sceleratus* Schweickerdt is of considerable importance, as this species is considered as the most toxic species by workers in the Union. No adequate feeding trials have been carried out as yet, with this species, under Rhodesian conditions, and until this is done it cannot be proved that it is definitely toxic, and even if it is, as seems very likely, it still remains to estimate its importance as a cause of deaths in cattle. The plant is only very rarely seen to be grazed by cattle, and only under conditions of poverty in spring, when the grasses are very poor are they likely to do so.

The plant is so widespread, however, and such a dominating feature of the veld that undoubtedly the veld and grasses generally would be much improved by its removal.

Of various weed-killers tried against the plant, sodium chlorate appears to be the only one of any value. Sodium arsenite would almost certainly work equally well, and perhaps better, but the danger of having quantities of it in the veld invalidates its use, and it was not thought worth while to test it experimentally. In addition, the tediousness of applying any non-selective weed-killer as a spot treatment over any large area, together with the considerable cost that would be involved, indicates that the method would not be worth while, except perhaps in small paddocks where, for instance, valuable horses

(which are particularly susceptible to *Senecio* poisoning) might be kept. Broadcasting sodium chlorate over infested veld would be simpler to carry out, but it is out of the question because of the much greater quantities necessary, and the fact that this would kill, for a considerable time, the grasses also.

The only control measures that remain are cultural methods involving the development of some suitable system of veld management. This involves long-term research not within the province of this department, but it is hoped that the observations on the factors controlling the distribution of the plant will assist in suggesting lines of approach to future workers on the problem. For instance, control of veld burning would probably slowly reduce the level of infestation, although complete cessation of burning would probably do more harm than good for other reasons, such as the effect on the tick population, and in the consequent deterioration of the grasses.

It is unlikely that merely resting the veld would be the complete answer, as it has been shown that a certain level of grazing and trampling assists in keeping down the number of plants to some extent.

The most satisfactory method would seem to be the planting of larger areas of such grasses as *Kikuya*, but there the difficulty is that such grasses are not capable of growing vigorously everywhere in the veld, and require rather specialised conditions for good growth.

Finally, as with all perennials of this type the frequent removal of the aerial parts of the plant reduces the stored food-materials in the roots, and this would undoubtedly slowly reduce the level of infestation, as the plant largely reproduces itself vegetatively by sending up clusters of shoots from the underground root system. The plant produces large masses of seed, but of these only a very small proportion are viable, as has been shown in the tests carried out by the writer. Consequently, frequent mowing, say, two or three times during the growing season, would be well worth while.

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3. Steyn, D. G.: "Senecio Poisoning in Animals," *Farm. in S. Africa*, March, 1934, p. 99.

4. Steyn, D. G.: "The Toxicology of Plants in S. Africa," p. 458.

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The Moult.

By H. G. WHEELDON, Poultry Officer.

The normal season for poultry to moult—fowls, turkeys and waterfowl—is during the late summer or beginning of autumn. This seasonal moulting is the natural process by which all birds renew their tattered plumage.

It is during that period that the majority of moulting birds cease to produce eggs. The termination of the laying season coincides with the moulting season before the winter sets in, approximately twelve to fifteen months from the commencement of laying as pullets. Whilst the annual seasonal replacement of plumage during the life of individual birds must be expected, every poultryman endeavours by careful management and hatching and rearing at the most suitable time of the year, to avoid what is termed the "pullet moult." The pullet moult, if it coincides with the seasonal moulting period of the mature flock, seriously affects the financial returns and must be avoided if possible. The aim should be the replacement of the laying flock of mature stock during their moult by raising a flock of pullets to maintain continuity in egg production without a break. This is effected to the best advantage by endeavourng to overlap the production from the pullet flock coming into lay with the natural cessation in production of the adult flock. The extent to which this may be accomplished determines to a great extent the profitable results in commercial egg production.

A high production when prices are high is partly a breeding problem, but it must be emphasised that the time of hatching, method of rearing the pullets, and the general management of the laying flocks during summer and autmn, all contribute to the production of eggs when eggs are scarce. Good results are centred mainly on the maintenance of a satisfactory egg production from the pullet flock as the pullets of the successive hatches reach productive maturity, and to a less extent upon the adult birds as their production normally decreases.

Early and Late Moulters. By observing any given laying flock of adult hens towards the end of the laying season, about December, a wide variation in the progress of the moult by individual birds can often be detected. It will be noticed that some birds have shrivelled combs, they are moulting and have stopped laying; others have almost completed the moult, recognised by the

number of clean new feathers, and also in the case of yellow-shanked varieties, by their bright yellow shanks. These are the early moulters, termed "moulting culls," renowned for their short laying cycle and a long out-of-production period, many of which may be recognised as early as the months of October or November, and should be eliminated from the flock. The duration of the moulting period can be shortened, and the average production of the laying flock well maintained, by the elimination, as suggested, of these culls at that time. Further observation of the flock a few weeks later will reveal birds with a mixture of new and old feathers; they are moulting normally section by section, but still laying; and with others there will be little if any evidence of moulting. These are said to be the gradual and late moulters respectively, and it is not unusual during late autumn to find in well-managed flocks a number of these birds almost bare, losing all their feathers in quick succession. The best producers start moulting before their egg production ceases. The gradual and late moulters remain in production until late autumn; they have laid heavily for twelve months and more, when they renew their feathers quickly after a short break in production. The best producers frequently cast nearly all their feathers at once in the last stages of the moult, late in the season. The new feathers require about six weeks to grow, when almost immediately the hens are ready to recommence profitable production for another season. The early moulters in the adult laying flock should be culled out early, before the month of January or the normal moulting season begins.

The early moulters or low producers actually take much longer to complete their moult, they are longer out of production and slower in coming into production again. They have been known to remain out of production for several months, their retention is not economical. Observations on recording individual birds have failed to prove that the early moulters are as satisfactory producers as the late moulters. Full-grown birds which moult before the normal season, unless they have had a setback, are generally poor egg producers. They represent as a rule a small percentage of the flock, including broodies and ailing birds, and should be culled out.

The condition of the plumage during summer and autumn is an indication whether individual birds are persistent layers or not. Hens which lay regularly usually retain their old ragged plumage longest. They are also hardy birds with a sound constitution, and generally profitable for another year's production. Normally as the old feathers are cast new plumage grows to take their place.

The Progress of the Moult. The order in which the moult progresses is first from the head and neck, then the body and back, followed by the primary tail and wing feathers last. The "neck" or "partial" moult may be noticed on occasion at any season of the year, even in good egg producers, it is enforced upon them often by some adverse variation in the diet or environment, and in this condition their egg production is normally fairly

well maintained. But if this moulting extends to the body sections the primary wing feathers are likely to be cast and may result in a complete moult. This stage is seldom reached out of season in the case of adult stock unless the hens for some reason have had a serious interruption in their egg production, forcing them out of production. In other words, the cessation of laying is likely to bring on a complete moult.

The pullet flock, on the other hand, is far more sensitive and susceptible to a complete moult, but only during the first three or four months after coming into production. This may be said to be a critical period for the pullet flock, during which time careful observation and management are necessary. They have, in effect, reached productive maturity at that stage and they have still to mature physically. An endeavour must be made to maintain their plump condition as pullets as they fill out, increase in weight, and reach full maturity. Over-production must be avoided at this period, as it is detrimental and may result in a premature moult owing to loss of condition. It is during this period that pullets require careful management and feeding; above all, avoid a forcing diet or frightening and upsetting them temperamentally. Their production should be in the vicinity of 50 per cent., and the grain feed supplied on a liberal basis in addition to some mash until they are fully matured. Only then is a full standard laying mash recommended.

Fowls seldom lay when the majority of the new feathers are growing, but exceptional individual birds with good vitality are occasionally found to continue egg production during the whole of their moult. Generally speaking, when adult fowls are kept in full lay moulting is delayed to some extent beyond the normal season. It is obvious, therefore, that the later a hen commences to moult in the autumn when her production ceases, the longer will be her laying season, and hence the greater her egg yield.

The date of hatching does not denote the actual time for moulting. One cannot be guided by any hard and fast rules, but there are certain factors which are known to influence the susceptibility to moulting, especially with the pullets, which must be avoided. The management and environment play a very important part in the maintenance of the production of any given flock during the moulting season. The first half of the poultry year, commencing from January, is the most remunerative period for commercial eggs, and sound management during that period of both the adult and pullet flocks means a full egg-basket when prices count.

Duration of the Moult. The question as to how long fowls take to moult and recommence laying depends largely upon the period at which moulting occurs, the age of, and treatment given to, the birds during this trying period. In the case of individual birds, moulting may cover a period of six weeks only from the time egg production ceases, for example, the late moulters, or it might extend over four or five months in the case of early moulters, completely to grow the new feathers. The average

egg production of a moulting flock might not be seriously affected for more than two months, especially when the early moulters have been culled out. Moulting will be noticed to extend over a longer period in unculled flocks, which can be detected by feathers lying about on the floor of the houses and runs and on examination of the growth of new feathers of individual birds. Evidence of a low average egg production over an extended period is another indication.

The old stud stock as a rule take longer than young birds to grow their new feathers; they often require assistance to hasten them through to the productive stage, and they should be housed apart from the younger stock for closer observation and treatment. The old stock, as with the young stock, selected for the next breeding season must have moulted and production have recommenced in time for the breeding season. Also the yearling birds which have been retained in the laying flock for another season should be given attention to get them back into production without undue delay. They would be profitable egg producers for a further season if managed properly and assisted through the moult in time.

Management of the Flock during the Moult. We are now dealing with our valuable adult breeding stock and the profitable producers composed of the commercial laying flock after culling the poor producers. The whole of the pullet flock reared the previous season will have reached laying maturity and will have been transferred to their permanent laying quarters as they come into production. The annual routine is to have them all settled in their permanent laying quarters as they reach the productive age by the end of March. It is necessary to maintain a satisfactory egg yield from them. Any surplus pullets, particularly those which have failed to reach maturity within a reasonable time, the unhealthy and weak birds, should be disposed of rather than retained, to avoid overcrowding the laying houses. The breeding flock, on the other hand, should be given special treatment from the month of January or February each year with a view to forcing a moult in preparing them for the breeding season. This applies to the old breeding stock as well as the young selected breeders after their recording period which by now has terminated. The aim should be to treat them as potential breeders. They have been productive for a year, and restricting their egg production would enforce a moult. This is desirable as they require a rest from producing eggs, their condition and vigour necessarily must be restored and they should be assisted quickly to grow their plumage before the commencement of the incubation season. The best results in hatchability, and strong healthy chicks, can only be expected from stud stock which is in fit breeding condition.

Apart from sacrificing the egg yield of the breeding stock for commercial purposes at a time when egg prices are high, poultrymen may find it advantageous to forego to some extent the production of a proportion of the adult laying flock as well.

The commercial laying flock is generally composed of: (1) the pullet flock; (2) yearling hens which are completing their first year's production; from these the breeding birds have been selected. On some farms the practice is to retain a flock of second-season hens for a third year, and on other farms the flock is composed entirely of pullets, in which case the commercial flock is renewed annually by pullets.

It is questionable whether third season birds are an economical proposition, but there are advantages in retaining the best of the yearling flock for another season's egg production. Their average production should be almost equal to, if not as great as, that of the pullet flock. When older birds than pullets are retained for another season the proportion should be: pullets 60 per cent. and yearling birds 40 per cent. of the normal housing capacity of the commercial flock.

It might be questioned whether forcing a moult on the yearling commercial flock is a good practice. The alternative is to allow this flock to exhaust itself in egg production as the moult takes a natural course. These birds have laid heavily for twelve months or more and they are capable of profitable egg production for a further reasonable period at a time when egg prices are high until the moult normally becomes well established. On the other hand they are to be retained for another season's egg production, and the pullet flock should be, by the month of April, in full production. The decision mainly rests on whether the finances of the farm can withstand, at a time when egg prices are high, sacrificing approximately 40 per cent. of the production of the laying flock.

It is suggested that the advantages outweigh the disadvantages in systematically forcing the yearling flock to moult in April, but towards the termination of their second laying season they should receive special treatment to stimulate the maximum production with a view to disposal of this entire flock when the moult is well established. A similar practice is recommended in the case of the yearling flock when the commercial flock on farms is composed entirely of pullets. An increase in the amount of meat meal by 5 to 10 per cent. from December is recommended to obtain the greatest production of eggs when egg prices are high. It means additional profit until the moult becomes established late in autumn, and as their production becomes unprofitable the flock is disposed of as culls. The second-season birds and the pullet flock mainly contribute to the egg basket during the time the yearling flock is moulting. The yearling stock which has laid heavily for twelve months should be moulted by June when they would be expected after this rest for two months to produce eggs profitably for another season. The yearling flock, therefore, should be encouraged to moult in April. A systematic clean cut in their production annually by forcing a moult on them is desirable if the average production of a commercial flock is to be maintained satisfactorily for the rest of the year; this is preferable to allowing the moult to take its course as arranged in the case of the second-season stock which is to be culled. It

is a profitable practice as a rule. Simply reduce the protein content of the ration; when in two or three weeks there is a marked decline in production the flock should be fed a good laying ration.

Obviously this moulting flock will be at a disadvantage in regard to the profit and loss account for a time, and although they have been profitable producers during the previous twelve to fifteen months as pullets, they are required to repay the cost of food consumed during their moult. It is important not only that profitable birds should be retained for the following season but it must be realised that their second productive season coincides with the period when egg prices are receding. The profit over cost of food will not be as great then as when they commenced laying as pullets and the market price for eggs was at that period ascending. A debt redemption is necessary before the farmer can realise a profit from these birds and the sooner they are moulted and recommence laying about June the sooner will this cost be covered, the longer also will be the productive period before the flock is again due to moult nine months later and finally culled at the termination of their second laying season. When the production of the yearling flock recedes to approximately 40 per cent. about April in well-managed flocks, cull out the balance of any inferior surplus stock and systematically encourage the flock to moult with a view to egg production two months later. The profitable period of these birds will be otherwise shortened accordingly. As pullets their production period extends approximately from January or February to the following year in March.

The ration for these birds after their first and subsequent seasonal moulting periods must be sufficiently stimulating for satisfactory egg production. A standard laying mash is necessary, containing sufficient animal protein; the birds otherwise are likely to fatten, which means a reduced egg yield. A good precaution if there is evidence of delay in responding to their mash ration after the moult is to increase the meat meal by 10 per cent. for a week, this often proves effective in stimulating production at that period. The suggested increase in animal food could be confined to a supplementary feed of moist mash, given in the morning daily, without any adjustment to the regular ration.

Forcing the Moult. The flock as a whole would be moulting naturally to some extent at the time a general moult is enforced and the birds will be in a lean hard condition, active and healthy, and their egg production as a rule stands in the vicinity of 40 per cent., the inferior birds having been previously culled out. The stock are receiving a standard balanced ration. The aim then would be to encourage a general flock moult and to hasten them through it. The simplest method of encouraging or forcing a moult on the flock to be moulted would be to make a drastic adjustment to the normal diet. A reduction by 50 per cent. of the animal protein in the mash is recommended. This would restrict egg production, and as the birds are already partly in the moult, it would be a favourable opportunity to enforce a general

moult. A reduction in the animal protein is almost certain to affect adversely the egg prduction by 50-75 per cent., and the birds would then moult in earnest. The normal ration should be restored to them containing the full quantity of animal protein when there is, in three to four weeks, a marked decrease in production, and the majority of the birds are noticeably growing their new feathers.

A nitrogenous diet is required for the quick growth of new feathers just as it is important for satisfactory egg production. Sunflower seed is a valuable addition. Fifteen to 20 per cent. in the grain feed during this period owing to its oil content will assist the growth of the new feathers. The renewal of the plumage not only necessitates a nitrogenous ration but it would stimulate the reproductive organs sufficiently to bring the birds into production simultaneously with the completion of the moult.

Semi-starvation by limiting the quantity of food, or undue delay in restoring the animal protein at this period, will only prolong a moult. Therefore encourage the layers to moult in April by a sharp reduction in the animal protein until the egg production is interrupted. There should be a marked decline in the egg yield in two or three weeks, when the normal laying ration, a highly nitrogenous one, should be again fed to them.

The breeding stock should be similarly treated during the month of February, to have them ready for the breeding pens about April or May. When the breeders are allowed to moult naturally, it will take its course over an extended period; the result is that some of the birds will be more advanced in the moult than others, with inevitable delay in egg production to meet the requirements for incubation in time for the breeding season. The hens are to be removed to the breeding pens when they are well fledged, and as their production improves the male birds are placed in the pens about two weeks before incubation is due to commence.

A moist mash given in the early morning is beneficial in addition to the usual dry mash supplied ad lib. Moulting birds are inclined to consume less food as a rule and a moist mash would be a desirable change in stimulating their appetite. They would require in addition about 1 oz. of grain per bird daily, fed in litter to encourage scratching exercise. Grit, charcoal and oyster shell must be supplied ad lib. with ample green food daily and fresh clean water to drink. Provide suitable conditions for dust bathing.

A good substitute for sunflower seed is linseed, which can be conveniently incorporated in the moist mash as a jelly, the proportion being 1 tablespoonful of whole linseed, stewed to a jelly in one pint of water. Take the required amount of mash for a given number of birds, allowing ½ oz. per bird, and a sufficient quantity of linseed jelly mixed with the mash to a crumbly consistency as a morning feed. This treatment is particularly beneficial to old stud birds, males and females, for a period of one or two weeks, as old birds often "hang" in the moult.

It is nourishing, it promotes the growth of new feathers, and improves the lustre of the plumage. In this respect linseed is particularly valuable for exhibition birds.

Moulting birds are as a rule inactive and they have a tendency to fatten unless suitable rations are fed to avoid it. When they have completed the moult they are also observed to be less active and less flighty than they were as pullets. The birds must be given a satisfactory ration to meet their requirements for maintenance and egg production with a view to minimising any tendency to become fat. A standard laying ration is essential for second-season birds after the first as well as the successive moulting season. A lack of protein in the form of animal food will soon become evident by a reduced egg yield, these birds may in consequence become too fat. Yearling hens require 5-10 per cent. more animal protein than is required for the pullets.

The Pullet Moult. This may be termed a "premature" or "false moult," which, in conjunction with the "normal" or "annual moult" of the adult flock, has a very important bearing on the egg output of the country, and when it occurs it means financial loss to the farmer. The most critical period is during the first three to four months after pullets have reached laying maturity and commenced to produce eggs. The ration at this period should be less forcing than the standard laying ration for the mature flock. They should receive a greater proportion of grain feed, or a reduction in meat meal by 25 per cent. of that which should be contained in a laying mash. It is during the normal moulting season that a marked shortage of eggs is experienced, and it is during this season of the year that our limitations are brought home to us, especially in regard to the pullet flock. Although a shortage of eggs is experienced in the country as a whole, there is no doubt that there are successful individual poultry farmers whose production is not very seriously curtailed during this period, and it is only when the successful poultry farmers make the majority that the annual shortage will become less acute, because the experienced poultry farmer raises pullets successfully to take the place of the moulting adult birds. The whole question seems to be based on experience in the management of the laying flock. The extent to which anyone can take advantage of this high-price period for eggs depends upon the ability to raise fresh stock each year to replace a proportion of the previous year's stock, and having raised the young stock, to prevent them during some seasons more than others from going into a premature moult. In that respect readers are reminded that the "cockerels" are very seldom affected by a premature moult, except under adverse conditions, for example, fighting and general molestation of one another may cause a partial or neck moult among the very early hatched cockerels. The pullets are more susceptible, and this may be accountable first to the highly developed nervous system of young productive birds, which in turn is more sensitive to the environmental conditions, and adverse influences, chiefly forcing egg production, drastic adjustments to the ration, and other disturbances, are likely to bring on a pullet moult.

It will be noticed that tame, friendly, high-producing pullets are less affected than nervous or timid birds which are producing heavily. Having, therefore, hatched the pullets at a favourable time and having provided them with comfortable conditions, proper nutrition and a regular system of routine, it might be assumed that the pullets would behave satisfactorily provided there is no untoward disturbance which affects them temperamentally, such as a fright or disturbance caused by dogs, hawks, and other wild vermin, or handling the flock for dosing, and unsettling them by moving them from one house or locality to another when in full lay. When they have settled down in their laying quarters they should be disturbed as little as possible. Rough handling by attendants, too early hatching, over-production and adverse changes in their nutrition are perhaps the most common causes. All of these factors deserve some consideration in the question of the "pullet moult" which successful poultrymen who study the requirements and well-being of their pullet flock are able to deal with effectually. Similar examples may be recalled in other classes of productive stock when the production may be affected—those who are familiar with the highly productive milch cow have no doubt noticed a decreased yield in the milk when the regular milker is changed, as will irregularity in milking, rough handling or other disturbances affecting them temperamentally.

It is not unusual to find a small percentage of precocious early hatched pullets maturing more quickly than the majority of the early hatched stock, but this cannot be avoided entirely and fortunately it has never any serious consequences even if a few of these birds do moult.

The majority of early hatched pullets have been known to lay consistently without falling into a complete moult, but during the same season later hatched birds from the same strain might be found to moult; although it seems difficult entirely to eradicate the moulting tendency altogether in every flock of layers, careful management would certainly minimise it, even if the moult is due to some extent to precosity, which is hereditary. Those which are affected by a complete moult during April and May, especially those with shrivelled combs, should be culled from the flock, for disposal. The birds with flexible combs though moulting, generally prove to be profitable with a production of 120 to 150 eggs in the season. It is generally supposed by many poultry farmers that the cessation of laying is the immediate result of a premature moult, but careful observation will show that in most cases the reverse is the case.

Points to be considered in minimising the "pullet moult" may be summarised in the following:—

Suitable Houses. Within the limits of the walls of the houses lies one of the important secrets in the successful prevention of the pullet moult; not only must adequate accommodation be provided without overcrowding the perches and hoppers, but sufficient ventilation, and the importance of freedom from parasitic vermin

cannot be over-emphasised. The roof must be weather proof and the floors impervious to damp and insect vermin. The aspect of the houses should be north, north-west, or north-east in Rhodesia, and shelter and shade should be provided.

Maintaining Health. For the best results, when suitable housing is provided, the birds should be confined during the rainy season, but they must be given plenty of scratching exercise to keep them healthy by working for their grain food. The food can be raked into the litter once or twice a day, which will keep the birds contented and well occupied for several hours. Confinement is likely to give better protection and will avoid having to drive the birds into the houses when it rains. In addition to the grain food it is necessary to give a well-balanced laying mash of good quality. The mash must be nourishing to provide for both production and development—special attention in this respect will be well repaid. Most of the pullets will develop better, continue to lay, and moulting avoided, when handled carefully with a view to keeping them contented, busy, undisturbed, and free from disease and insect vermin.

Nutrition. Laying birds require plenty of good wholesome food. The pullet moult may in no small measure be attributed to lack of proper nutrition. As pointed out, it is probable that if the pullets are kept laying steadily they will not moult—or if they do, it will only be a slight neck or partial moult. If the pullets stop laying, during the normal moulting season of the old stock, they are almost sure to pass through a complete moult. Unless pullets which are hatched early receive proper treatment and are suitably nourished to provide for both production and development, they would be more susceptible to moulting. Egg production is interrupted if there is something lacking in the management. It is necessary therefore to perfect the management and environmental conditions as much as possible to prevent or minimise the pullet moult.

Price List of Forest-tree Transplants, Ornamental Trees and Shrubs, Hedge Plants, Creepers and Seeds.

OBTAINABLE AT THE GOVERNMENT FOREST NURSERY, SALISBURY.

AS AT 1st SEPTEMBER, 1947.

1. Transplants of forest trees, etc., are obtainable at the subjoined rates and subject to stocks and containers being available.

2. Orders should be addressed to the Conservator of Forests, Salisbury; or Manager, Forest Nursery, P.O. Box 387, Salisbury.

3. **All orders must be accompanied by a remittance in cash, bank note, postal order, draft or cheque, made payable to the Department of Agriculture, Salisbury. Under no circumstances will plants or seeds be sent out or taken away from the Nurseries unless paid for. Stamps to the value of one shilling will be accepted.**

4. All transplants are despatched at Rate 10 on railways at purchaser's risk. The transplants are watered as far as this is possible by the railway staff.

5. All prices quoted are for delivery free at any railway station or siding in Southern Rhodesia. **Road motor service charges are payable by consignee and must be included in remittances.**

6. Purchasers of trees contained in tins of 25 trees or boxes of 50 trees are requested to return the tins or boxes, carriage forward, to the nursery from which they are obtained, or to the Manager, Forest Nursery, Salisbury. **If the tins or boxes are not returned within two months from date of issue, they will be charged for at 6d. and 1/- each respectively.**

7. **No plants, except forest trees, will be reserved. Orders will be executed in order of receipt as trees are ready for despatch. Every effort will be made to comply with instructions of purchasers.**

8. Transplants of forest trees, when quoted at per 1,000, are grown in half paraffin or petrol tins containing 20 to 25, or boxes containing 50 transplants. The average weight of each tin is about 25 lbs. and a box 50 lbs.

9. Transplants of a larger size usually in stock.

10. Shrubs and ornamental plants in single tins have a weight of about 5 lbs.

11. To purchasers of forest trees only, the following reductions are made:—

(a) When the number exceeds 1,000, the price is £3 5s. per 1,000.

(b) When the number exceeds 5,000, the price is £2 14s. per 1,000.

12. Orders for seed are posted or railed free of charge.

13. Though every care is taken to supply trees and seeds true to name and of good quality, no guarantee can be given in this respect, more particularly in regard to seed.

14. Intending tree planters are invited to apply to the Conservator of Forests, Division of Forestry, Salisbury, for advice as to the most suitable trees for growing in the various climates and soils of the Colony, and on the best methods to adopt in the formation of plantations, wind breaks and shelter belts.

15. **No responsibility taken after trees, shrubs, etc., have been accepted by the Railways. Any claim for loss or death should be made to the Railway Company.**

16. This list cancels all previous lists.

17.—Hours of Business.—Weekdays, 9 a.m. to 1 p.m. and 2 p.m. to 4.30 p.m. Closed on Saturdays, Sundays and Public Holidays.

Price of Transplants.—For convenience, the following symbols are used to indicate the purchase prices of transplants:—

A—Trees, 25 in tin or 50 in box, at 2s. 3d. per tin or 4s. 6d. per box; £3 5s. per 1,000; £2 14s. per 1,000 for orders over 5,000.

E—Trees and shrubs at 9d. each; extra large from 2s. 6d. each.

Botanical Name.	Common Name.	Remarks.	Price of trans-plants.	Price of seed.	
				Lb.	Oz.
Callitris calcarata ...	Black cypress pine ...	Usually rather slow growing, but reaches a fair size and produces a valuable durable softwood. Suited for dry country planting, especially in sandy soil. Good shelter for orchards, etc.	A.E.	15s.	1s.
Casuarina *cunninghamiana*	Beefwood	A fine large shade tree, suitable for avenues and narrow belts. Requires deep soil in drier localities. The foliage is useful for stock fodder, and the tree stands lopping well.	A.E.	...	2s. pkt. 1s.
Cedrela odorata		A rapid-growing tree similar to Cedrela toona, but with lighter foliage. Likely to do well on heavy soils, fairly free from frost. 30 to 40 feet in height.	A.E.	15s.	1s.
Cedrela toona	Toon tree	A rapid-growing, handsome, semi-deciduous tree, suited for moister localities where frost is slight. Yields a valuable soft timber. Recommended for shade and ornament.	A.E.	15s.	1s.
Cupressus arizonica ...	Arizona cypress	A hardy evergreen tree, suitable for dry localities, but requiring a well-drained and rather deep soil. Useful for shelter belts and also for hedges when closely planted.	A.E.	15s.	1s.
Cupressus lusitanica ...	Portuguese cypress ...	A fast-growing cypress, producing an excellent softwood timber, but requires a moist, cool climate and a good soil. May well be used for shelter and hedges in favourable localities.	A.E.	5s.	6d.
Cupressus sempervirens, var. horizontalis	Common spreading cypress	A hardy cypress, suited for limestone as well as other soils. Not so frost or drought hardy as Cupressus arizonica. Suitable for shelter and hedges.	A.E.	15s.	1s.
Cupressus sempervirens, var. pyramidalis	Common upright cypress	An ornamental tree for gardens and cemeteries. Also useful as a shelter tree. Grows under similar conditions to the "var, horizontalis."	A.E.	15s.	1s.

Cupressus torulosa ...	Himalayan cypress... ...	A good tree for timber, hedges and shelter. Withstands much cold and drought. Not very soil exacting, but will not stand waterlogging. Fairly frost-hardy. A very reliable tree.	A.E.	10s.	9d.
Eucalyptus botryoides	Bangalay	A large-leaved, heavy-foliaged gum. Quick growing. Suitable for granite and red soils. Withstands frosts, but not very drought-resistant.	A.	15s.	1s.
Eucalyptus citriodora ..	Lemon-scented gum ...	A clean-boled tree, producing an excellent timber. Leaves lemon-scented. Suited for wetter regions and on the better soils in the lower rainfall regions. Will not withstand much frost or drought. Flowers prolifically, rendering it very useful for honey production.	A.	15s.	1s.
Eucalyptus crebra... ...	Narrow - leaved iron-bark	A slow-growing, deep-rooting species, producing excellent timber. Withstands drought and light frosts.	A.	15s.	1s.
Eucalyptus maculata ..	Spotted gum	One of the best trees for timber production or shelter in the wetter areas, being fairly hardy to drought but not to frost. Produces an excellent timber.	A	15s.	1s.
Eucalyptus maideni ...	Maiden's gum	A very fast-growing, large tree, with bluish foliage in youth. Fairly drought and frost resistant. Will grow on poor soils if deep and well-drained. Produces a good, strong, useful timber.	A.	30s.	2s.
Eucalyptus melliodora	Yellow box...	A medium-sized tree, useful for shelter belts. Produces a tough, durable timber. Very resistant to drought and frost. Valuable for honey production, having abundant sweet flowers.	A.	15s.	1s.
Eucalyptus microcorys	Tallow-wood	A neat heavily foliaged tree suitable for high rainfall areas.	A.	15s.	1s.

Botanical Name.	Common Name.	Remarks.	Price of trans-plants.	Price of seed. Lb.	Oz.
Eucalyptus paniculata	Grey ironbark	A very good timber tree, with heavy foliage. Suitable for the moister regions, with a deep, fertile soil. Withstands some drought, but is frost-tender. Yields an excellent, hard, durable wood.	A.	15s.	1s.
Eucalyptus punctata ...	Leather jacket	A tree of fair size, yielding a good, durable timber. Adaptable as regards soil and climate, but will not withstand a dry cold climate.	A.	15s.	1s.
Eucalyptus robusta ...	Swamp mahogany	A quick-growing, shady tree, which requires a moist soil for best results, but will grow under fairly dry conditions, provided frost is not severe. Recommended rather for shelter belts than plantations.	A.	15s.	1s.
Eucalyptus rostrata ...	Red gum	Produces an excellent and durable hardwood. Withstands drought, heat, brak, flooding and a good deal of frost. One of the best species for planting in Southern Rhodesia, except in sour soil and wet mountain regions.	A.	15s.	1s.
Eucalyptus saligna... ...	Sydney blue gum	A fast-growing, useful tree, producing a useful medium hardwood. Thrives on deep, fertile soils in the heavier rainfall areas. Tender to frost and drought.	A.	15s.	1s.
Eucalyptus tereticornis	Forest red gum	Similar to Eucalyptus rostrata, and can be planted along with it, except in areas liable to flooding and great heat. Perhaps not quite as drought-resistant.	A.	15s.	1s.
Grevillea robusta	Silky oak	A handsome tree which thrives best in moist, warm localities. Useful for ornament, shade and timber. Frost-tender and not resistant to drought. If the locality is unsuitable, it may grow well for several years and then die out.	A.E.	...	pkt. 1s.

Jacaranda mimosaefolia	Jacaranda	An ornamental deciduous tree with feathery foliage and abundant blue flowers, which appear in spring. Best development is attained in the moister regions, but the tree withstands drought to a surprising extent, and may be planted in the drier regions if the soil is reasonably deep and fertile. It is tender to cold and frost, and may need protection in its earlier youth.	A.E.	20s.	1s. 3d. pkt. 1s.
Pinus canariensis	Canary Island Pine ...	Hardy to drought, but not to severe frost. Best suited for planting on higher altitudes and in higher rainfall areas. Slow growth in early youth, then more rapid in later years. A handsome tree with inverted, umbrella-like branches, not spreading. Yields an excellent softwood timber.	A.E.	15s.	1s.
Pinus halepensis	Aleppo pine	A drought-resistant pine which will grow on limestone and shale soils. Not recommended for plantations, but can be used for shelter and ornamental purposes in the drier regions.	A.E.	15s.	1s.
Pinus patula...	Patula pine	A fast growing pine with graceful drooping needles. Does best in higher rainfall areas. Produces a useful softwood.	A.E.	15s.	1s.
Pinus radiata (insignis)	Remarkable pine	A large tree of very rapid growth, producing a useful softwood. Most at home in the heavier rainfall areas. Does not like sour or poorly-drained soils. Frost-hardy but not drought-resistant, usually failing at an early age in the drier regions. It should be planted with caution in areas under 30 inch rainfall. Recently this tree has been severely attacked by *Diplodia pinea* and it is advised that the Forest Department be consulted when new plantations are contemplated.	A.E.	15s.	1s.
Pinus longifolia	Chir pine	A somewhat slow-growing pine, but useful to plant in localities where the climate and soil are doubtful at the higher elevations. For timber and ornamental purposes. A useful tree in all respects.	A.E.	15s.	1s.

Botanical Name.	Common Name.	Remarks.	Price of trans-plants.	Price of seed. Lb.	Price of seed. Oz.
Populus alba	White poplar	A rapid-growing poplar, requiring a good, deep soil in close proximity to running water. Propagated by suckers. Deciduous.	Suckers at 9s. per 100		
Populus deltoides, var. missouriensis	Carolina poplar...	A very fast-growing poplar, producing a very good timber for matches. Requires a rich, moist, alluvial soil. Moderately frost-hardy. Does not like stagnant water.	E.		
Salix babylonica	Weeping willow	A useful timber and ornamental tree, requiring a moist, well-drained soil which is occasionally flooded. Not suited for ground in which water is stagnant.	4d. each.		
Ornamental Trees, Shrubs and Hedge Plants.					
Abelia floribunda	—	A shrub with myrtle-like leaves, evergreen if watered. Pink-white flowers in profusion. Is used for hedges in Natal.	E.		
Aberia caffra	Kei apple	A rough, thorny, impenetrable shrub, making a good hedge. Withstands frost and drought well. Suited for all but the driest areas of the Colony. More useful than ornamental. Slow growing.	E.		
Acacia baileyana	Bailey's wattle	A small ornamental tree with blue foliage and yellow flowers.	E.		
Acalypha marginata ...	—	Margin of leaf crimson; a shrub; will grow to 10 feet in height, or clipped to shape. Very useful to give colour to shrubbery.	E.		
Acrocarpus fraxinifolius	—	A small tree up to 40 feet in height; attractive foliage. Fast growing.	E.		
Agapanthus umbelatus	Cape Lily	Blue variety.	E.		
Alstonia scholaris... ...	—	A white flowered shrub, 6 feet high, similar to Oleander.	E.		
Bauhinia galpini	Pride of de Kaap	A rambling shrub, bearing orange-red flowers. Hardy.	E.	...	pkt. 1s.
Bauhinia acuminata ...	Bauhinia	A small tree, flowering profusely in early spring. White flowers. Hardy.	E.	...	pkt. 1s.

Bauhinia purpurea ...	Bauhinia	Similar to the Bauhinia acuminata, but with mauve flowers. Hardy.	E.	... pkt. 1s.
Berberis darwinii	Berberis	Dwarf evergreen shrub with orange flowers and orange berries.	E.	
Bolusanthus speciosus	Rhodesian tree wistaria	An indigenous semi-deciduous tree with blue flowers at the end of long stalks. Ornamental.	E.	
Buddleia sp.	Blue buddleia	A medium-sized shrub with sweet-scented blue flowers. Useful as a hedge. Rapid-growing, but frost-tender.	E.	
Buddleia sp.	Yellow buddleia	A rank-growing, yellow flowering shrub. Rapid-growing. Frost-tender. Both Buddleias are very subject to leaf-eating beetles.	E.	
Callistemon speciosus	Bottlebrush	A scarlet-flowering shrub of drooping habit. Makes an excellent hedge if trimmed along the top only.	A.E.	... 2s. pkt. 1s.
Calodendron capense ...	Cape Chestnut	A fine ornamental tree up to 20 feet high with white flowers marked with pink. Sometimes takes up to 10 years before flowering.	E.	
Carica papaya	Pawpaw	A small tree with large, dark green foliage, bearing large edible fruits.	E.	
Casimiroa edulis	Mexican apple	A large, rapid-growing tree, 30-40 feet in height, evergreen, and bears a delicious fruit. A fine shade tree if pruned to stake early.	E.	
Cassia sp.	Caruda	Evergreen tree up to 20 ft. high with masses of yellow flowers.	E.	
Cassia capensis...	Cape laburnum...	A rapid-growing shrub, bearing masses of bright yellow flowers.	E.	
Cassia laevigata...	—	Yellow flowering shrub from Uganda.	E.	
Cestrum aurantiacum	Ink berry	A small shrub, bearing orange flowers in profusion.	E.	
Castanospermum australe	Australian chestnut ...	A very fine shade tree similar in growth to Cedrela but with shiny evergreen leaves and pretty flowers.	1s. 6d. & 2s. 6d. each.	
Citharexylum sp.	—	A deciduous shrub up to 15 ft. in height. Grown for its lovely leaves, which become highly coloured in autumn.	E.	
Croton sylvaticus	Mount Selinda linden	A large-leaved, deciduous tree from Melsetter.	E.	
Cryptomeria japonica...	Japanese Cedar...	A quick growing coniferous tree only suitable for high rainfall areas.	E.	

Botanical Name.	Common Name.	Remarks.	Price of trans-plants.	Price of seed. Lb.	Price of seed. Oz.
Cryptostegia grandiflora	—	A decumbent creeper with shiny foliage and large mauve flowers. Not recommended as a climber.	E.		
Cyphomandra betacea	Tree tomato	The well-known tree tomato. Will grow anywhere where Paw Paws will thrive.	E.		
Datura arborea...	Tree potato	A large shrubby tree, up to 30 feet in height, with large purple flowers. Very quick grower. Fruit poisonous.	E.		
Deutzia crenata	Bridal wreath	A small deciduous shrub with double white flowers, tinged slightly pink, on long, drooping stalks.	E.		
Dodonea viscosa	—	Indigenous shrub. Makes a good hedge in Matabeleland but dies out after a few years in Mashonaland.	A.E.		
Dombeya sp.	—	A small shrub 6 feet high, pink flowers.	E.		
Duranta alba	White tree forget-me-not	Similar to Duranta plumieri but has white flowers.	E.		
Duranta plumieri	Tree forget-me-not... ...	A medium-sized, deciduous shrub with blue flowers. Useful as a hedge. Very hardy.	E.		
Eranthemum sp.	—	A shrubby herbaceous plant covered with intense blue flowers in the autumn, likes shade, evergreen, 3 feet high.	E.		
Eugenia braziliensis ...	Brazilian cherry	A small shrub, bearing scarlet-coloured, edible fruits. A useful hedge plant.	E.		
Euphorbia splendens ...	Christ thorn...	A small thorny shrub with bright scarlet flowers. Suitable for low hedges and borders.	E.		
Ficus petersii	Wild Fig	Indigenous tree up to 40 ft. high. Evergreen and shady, but has large surface roots.	1s. 6d. each.		
Freylinia tropica	Inyanga hedge plant ...	A useful hedge shrub. Indigenous.	E.		
Gardenia florida	Katjepeering	A compact, evergreen shrub with dark green, glossy leaves and pure white, sweetly-scented double flowers.	E.		

Hamelia patens...	—	A compact shrub 8 feet to 10 feet in height, flower orange-yellow tubes, a showy shrub.	E.
Heliotropium peruvianum	Heliotrope	A small shrub with sweet-scented lilac or nearly white flowers. Suitable in flower border.	E.
Hibiscus rosa-sinensis	Chinese rose	Evergreen shrub with numerous scarlet flowers. Double and single varieties.	E.
Holmskioldia sanguinea	Holmskioldia	A fairly hardy shrub, bearing a profusion of brick-red flowers in large bunches. Suitable for hedges.	E.
Holmskioldia sp.	Holmskioldia	A yellow-flowering, handsome shrub similar to Holmskioldia sanguinea.	E.
Hydrangea japonica ...	—	A well-known shrub. The flowers are naturally pink, and are changed to blue by feeding the plants with small quantities of Nitrate of Soda, as they grow.	E.
Hypericum lanceolatum	St. John's wort	A small, yellow-flowering shrub. Multitudes of flowers.	E.
Iochroma tubulosa ...	Iochroma	A shrub with dark blue flowers.	E.
Khaya nyasica	Banket Mahogany... ...	An evergreen timber tree, fairly fast growing on deep soils.	E.
Lagerstroemia eavesii	Mauve Pride of India	Similar to Lagerstroemia indica but has mauve flowers.	E.
Lagerstroemia indica ...	Pride of India	A large ornamental shrub, with pink flowers. Handsome and hardy.	E.
Lavendula vera	Lavender	The well known aromatic shrub with grey foliage.	E.
Ligustrum lucidum ...	Chinese privet	An excellent hedge plant or ornamental shrub or tree. Can be clipped into shape. Liable to die off in patches or lose its lower leaves unless planted in moist soil of fair depth. Propagated from cuttings or seeds.	A.
Lagunaria patersonii ...	—	An evergreen tree with pink flowers, 30 feet high.	E.
Mangifera indica	Mango	The well known fruit tree.	1s. to 2s. 6d. each.
Melia azedarach	Syringa	A deciduous tree, producing a good light timber. Shallow rooting. Withstands drought well. Has fine lilac flowers and persistent yellow berries. Suitable for better rainfall areas and deep sandy soil, but will grow under severe conditions.	E.
Montanoa bipinnatifiddia	—	A large growing shrub with white flowers and a yellow centre.	E.
Morus sp.	Mulberry	A very large fruited variety.	E.

Botanical Name.	Common Name.	Remarks.	Price of trans-plants.	Price of seed. Lb.	Price of seed. Oz.
Moschosma	Rhodesia spirea...	A medium-sized, blue-flowering shrub.	E.		
Nerium oleander	Ceylon rose	The Oleander. Salmon-pink, also a white variety. Poisonous.	E.		
Parkinsonia aculeata ...	Jerusalem thorn	A light foliaged tree, up to 20 feet high, with little yellow flowers, very beautiful as isolated specimen on a lawn.	E.		
Peltophorum africanum	Rhodesian Wattle	Indigenous tree with yellow flowers.	E.		
Persea gratissima	Avocada pear	A tree with an edible fruit.	2s. 6d. each		
Philadelphus coronarius	Mock orange...	A pretty deciduous shrub, large scented white flowers in early spring.	E.		
Photinia japonica	Loquat...	A small evergreen tree with large leaves, bearing yellow edible fruit.	E.		
Phytolacca dioica	Belhambra	A rapid-growing, deciduous tree. Useful for ornament. Timber of no value, but seeds valuable as a poultry or cattle feed.	A.	...	pkt. 1s.
Pittosporum undulatum	Camphor laurel...	An Australian evergreen shrub, making an excellent hedge, with shining, green, scented leaves and scented berries.	A.		
Platanus orientalis... ...	Plane	Well known deciduous tree up to 30 ft. high. Will stand plenty of frost but apt to lose its leaves prematurely in dry areas.	E.		
Plumiera rubra	Frangipani	A handsome shrub with pinkish red flowers. Rather delicate.	2s. 6d. each		
Plumiera occulata	—	Similar to Plumiera rubra with white flowers. Orange-gold throat.	2s. 6d. each		
Poinciana regia	Flamboyant	A handsome red flowering, feathery foliaged tree. Very frost tender. Flowers best on stony ground.	1s. to 7s. 6d.		
Poinsettia pulcherrima	Poinsettia	A shrub with small yellow flowers surrounded by many large, scarlet, leaf-like bracts. Very showy. Double and single varieties. Also single pink variety.	E.		
Poinsettia albida	Poinsettia	As above, but with single yellowish white bracts.	E.		

Psidium cattleyanum	Purple fruited Guava...	This guava has shiny evergreen leaves and small purple fruit. More useful in the shrubbery than the orchard.	E.		
Psidium pomiferum ...	Guava	A small, hardy, evergreen tree, bearing edible, yellow fruit.	E.		
Punica granatum	Fruiting pomegranate	A shrub or small tree, having shining deciduous leaves, large scarlet flowers and large red fruit. Makes a useful hedge when well cut regularly.	E.		
Punica granatum flora pleni	Double flowered pomegranate	A useful shrub with double scarlet flowers. Does not bear fruit.	E.		
Pyracantha angustifolia	Hawthorn	Fruits golden and hang throughout the winter. Evergreen shrub. Useful as a coarse hedge.	A.E.		
Pyracantha crenulata ..	Hawthorn	Fruits scarlet. Evergreen shrub if watered in winter. Makes a good border or low hedge.	A.E.		
Rhus lancea...	Karreeboom...	A small indigenous tree of graceful appearance, yielding a very durable wood. Useful for ornamental purposes. Forms a fine hedge.	A.	10s.	9d.
Rhus vernicifera	Chinese Lac	Fast growing evergreen shade tree of medium height.	E.		
Russelia juncea...	Coral fuchsia	A pretty red-flowered shrubby plant about 6 feet high.	E.		
Salvia involucrata	Salvia	Shrubby herbaceous perennial, growing to six feet in height. Red flowers. Very suitable for cutting.	E.		
Schinus molle	Pepper tree...	A small evergreen tree with pendulous twigs and rose-coloured berries. Enjoys a hot sunny position but will mildew badly in humid heat. Suitable for the drier areas of the Colony only.	E.		
Schrebera sp.	—	An indigenous evergreen shrub with white flowers.	E.		
Spathodea campanulata	African flame tree... ...	A handsome, heavy-foliaged tree, bearing bright red flowers. Suited for the heavier rainfall areas on deep soils. Frost tender.	E.		
Spirea prunifolia	Cape May...	White flowered shrub four feet in height, in single and double varieties.	E.		
Sterculia acerifolia... ...	Australian Flame Tree...	Medium size deciduous tree bearing masses of scarlet flowers in November.	E.		

Botanical Name.	Common Name	Remarks.	Plants each.	
Sterculia discolor... ...	White Kurrajong	Recommended as a shade tree for the hot dry areas of the Colony.	E.	
Sterculia diversifolia	Black Kurrajong	An evergreen tree up to 30 ft. high with greenish-yellow flowers. Should do well in the hot dry parts of the Colony.	E.	
Streptosolon jamesonii	Streptosolon...	A shrub with orange-coloured flowers in dense masses and pale green foliage. Very frost-tender and delicate.	E.	
Tecoma smithii...	Tecoma	An upright, medium-sized shrub with tubular, bright yellow flowers. Forms a useful hedge. Fairly drought-resistant.	A. E.	... pkt. 1s.
Tecomaria capensis ...	Kaffir Honeysuckle ...	A pretty trailing shrub from the Cape, with orange flowers.	E.	
Thevetia neriifolia... ...	Thevetia	An evergreen shrub, bearing bell-shaped, yellow flowers. Hardy. Poisonous.	E.	
Thuya orientalis	Thuya	A very hardy conifer that withstands heat, cold and drought, and does not mind heavy soils. Slow-growing. Of small size. Very good for hedges.	A.E.	... pkt. 1s.
Tipuana speciosa	Tipu Tree	A showy tree with yellow flowers from South America.	E.	
Trichilia emetica	Natal Mahogany	A fine shade tree, evergreen, slow in growth, height to 30 feet, spread up to 50 feet.		1s. 6d. to 2s.6d.
Vitex Angus-Castus ...	—	A showy blue flowered shrub, does well in the most unlikely places.	E.	
		Climbers and Creepers.		
Ampelopsis veitchii ...	Virginia creeper	Too well known to need description.	E.	
Antigonon leptopus ...	Coral Creeper	A showy climber, bright pink flowers, forms large bulbs underground. Takes two or three years to reach flowering size, after this it makes a wonderful display yearly.	E.	

Aristolochia elegans ...	Dutchman's pipe	A rank-growing creeper. Heart-shaped leaves. Purplish crimson flowers, spotted yellow.	E.
Beaumontia grandiflora	Beaumontia	A large climber with heavy, glossy foliage. Large white, bellshaped flowers. Blooms profusely. Fairly frost-tender.	1s. 3d.
Bignonia chrysoleuca...	Lemon Shower	Similar to Golden Shower with lemon coloured flowers Deciduous.	E.
Bignonia jasminoides ...	—	An evergreen climber with mauve throated white flowers.	1s. 3d. each.
Bignonia tweediana ...	—	A self clinging climber with yellow flowers. Very showy whilst in flower.	E.
Bignonia venusta	Golden shower	Vigorous creeper. Rapid-growing. Bears masses of orange flowers all the year round. Very useful and hardy.	1s. 3d.
Bignonia speciosa	Bignonia	A rapid-growing, showy creeper, bearing large mauve flowers. Decumbent.	E.
Bougainvillaea splendens	Bougainvillaea	Vigorous climber. May be also used as a hedge. Bracts magenta. Fairly frost-hardy.	1s. 3d.
Clitoria ternata...	Mussel Shell Creeper...	A pretty blue flowered creeper but not very strong growing.	E.
Ficus repens...	—	A valuable climber for walls, etc., used in places where the Virginia creeper is grown, but clings to the surface much better than the latter, rather slow at first.	E.
Hedera helix...	Ivy	A dark evergreen climber. Best in shady, cool climates.	E.
Jasminum sambac... ...	Jasmine	A vigorous, evergreen shrub climber with large trusses of fragrant, white flowers.	1s. 3d.
Jasminum primulinum	Climbing jasmine	A yellow-flowering species similar to Jasminum grandiflorum.	E.
Lantana salviifolia... ...	—	A fine little creeping shrub with pink flowers, very suitable for rockwork, or edging borders, etc.	E.
Lonicera periclymenum	Honeysuckle (Woodbine)	Hardy climber with sweet-scented yellow flowers.	E.
Lonicera sempervirens aurea	Yellow honeysuckle ...	Climber with yellow flowers. Best kept well pruned or base becomes ugly.	E.

Botanical Name.	Common Name.	Remarks.	Plants each.
Passiflora edulis	Granadilla	A quick-growing climber, bearing edible fruits. Subject to woolly aphis if overshaded. A good trellis plant.	E.
Podranea brycei	Zimbabwe creeper	A rank-growing indigenous creeper with large, pink flowers.	E.
Rhynchospermum jasminoides	Star Jasmine	A white flowered evergreen creeper with strong jasmine perfume. Can be grown as a shrub.	E.
Rosa bracteata	Macartney rose	Plant with large green foliage and numerous white single flowers. Useful as a hedge plant.	1s.
Senecio macroglossus	Cape Ivy	An evergreen ivy leaved climber with yellow flowers.	E.
Stigmaphyllon ciliatum	Buttercup creeper	A light evergreen creeper with bright yellow flowers. Does best when growing with other creepers.	E
		Palms, Bamboos, etc.	
Arundo donax	Spanish reed	A reed growing 20 feet to 25 feet in height and 1 inch thick, and very superior to the indigenous variety.	Offsets 1s. 6d. each
Bambusa arundinacea	Whipstick bamboo	About 30 feet.	Offsets 2s. 6d. each
Bambusa sp.	Indian variety	Similar in growth to the Bindura, with very useful rods.	Offsets 2s. 6d. each.
Chamerops excelsa	Fan Palm	One of the best hardy tall growing fan palms.	2s. 6d. each.
Cyperus papyrus	Papyrus Grass	A very handsome subject for the water garden, or planted near the drip of a tap; it does best when growing in the water.	2s. 6d. each
Oxytenanthera abyssinica	The Bindura bamboo	The only variety indigenous to Rhodesia, giving very useful solid rods, very tough.	Offsets 2s. 6d. each.
Phoenix reclinata	Wild date palm	A very hardy palm, indigenous to the Colony.	—
Phormium tenax	New Zealand flax	A useful green foliaged plant, about 4 feet high with sword-like leaves.	E.
Washingtonia robusta	Fan palm	A strong-growing fan palm. Palms 2s. 6d. to 5s. each.	—
Succulents	—	A good selection of Aloes, Cotyledons, Mesembrianthemums, Kalanchoes, etc.; usually in stock.	1s. each.

Offsets of Bamboos supplied during rainy season only.

A Guide to Some Rhodesian Soils.

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SOIL INVESTIGATION.

Since the soil is the basis of all farming practice, and since its nature must be understood by conservation officers, agriculturists, land inspectors and all connected with the land, a short description will follow of those features of soil which determine its classification. A correlation will be arrived at in time between the soil types named (and those still to be identified) and such characteristics as erodibility, fertility, irrigability, etc., and it is desirable that in future all soils be named in terms of the listed soil types, as is the practice in Europe and America. It may be necessary for those soil officers concerned to identify soils in the field: where the type is in doubt, samples should be taken and submitted to the Chief Chemist. This article is designed to help in identifying soils and in sampling soils in the field for identification.

Nearly all soils have more or less distinct layers or horizons from the surface to the unaltered rock material from which they have been formed. The cross-section of horizons is known as the soil profile. The profile of an imaginary soil is given in Fig. 1. The true nature of a soil can be known only by examining its profile, not the surface soil alone. In Rhodesia, as already stated, the profiles are not very marked except in certain soils. In the red soils and in the sandveld the chief visible change occurs immediately below the surface soil.

UNITS OF CLASSIFICATION.

The different characteristics which distinguish different soils are parent material, colour, different horizons, texture, structure, special formations, prorosity, consistence and reaction.

A *series* is a group of soils having horizons of similar characteristics and arrangement in the soil profile, and developed from a particular type of parent material. Apart from texture (especially of the A horizon), the morphological features of the profile as shown in the physical characteristics and thicknesses of the soil horizons must not vary significantly within a series, particularly colour and structure. Generally, it may be said that those observable and mappable characteristics which are known to have,

or are likely to have, significance in the growth of native or crop plants, may be regarded as differentiating between series.

Each soil series is composed of one or more *types*, differentiated on the basis of the texture of the surface soil, so that the soil type name consists of a series name plus the textural class name, as, for example, Tatagura silty clay. The other characteristics of types are similar, although allowed to vary qualitatively to the same extent as is expressed by the differences in the class name of the type.

The different distinguishing characteristics may now be discussed in more detail.

Colour. Colour is important but it is not a conclusive indication of any particular characteristic: red colour, for example, may be indicative of good drainage and good aeration, or it may be inherited from the parent rocks, as in this country. Dark colour may indicate humus or it may be due to manganese. Yellow colour, particularly in the B layers, is usually due to imperfect drainage. In any case, the colour of all horizons must be meticulously reported, and it must be stated if the colour is uniform in a particular horizon, or patchy. The colours are more accurate when they are seen dry. In examining the colour direct sun illumination should be avoided as the shadows obscure the true colour shades. Noon is the ideal time to note the colour of the profile. The following colour terms only are permitted—the principal colour, or its modifier according to shade, modified by the word light or dark: as red, reddish-brown, dark greyish-yellow, etc.

Parent Material. By parent material is meant the unconsolidated mass from which the soil profile develops, not the bedrock from which parent material is itself produced by weathering. Parent materials may be of three kinds:—

(1) those formed in place through the weathering of the country rock,

(2) those transported from the place of their origin and re-deposited before they become subject to modification by soil-building forces, and

(3) organic deposits.

Under Rhodesian conditions the third class may be ignored; the second class occurs along river courses, sometimes in vleis, and often in valleys in hilly country. As stated previously, very useful information can be obtained from geological surveys. Whenever soil samples from a profile are submitted for indentification, a sample of the rock from which the soil is derived (if of Class I) should be included. The depth of soil, or of soil and unconsolidated parent material, over hard rock, where such formations lie near the surface, should be stated. Except in the Tatagura series, that will not always be possible, owing to the depth of the soil.

Figure I.

Organic debris lodged on the soil; usually absent on soils developed from grasses.		A_{00}	Loose leaves and organic debris, largely undecomposed.
		A_0	Organic debris partially decomposed or matted; frequently divided into sub-horizons.
The solum. (This portion includes the true soil, developed by soil-building processes.)	Zone of eluviation, or leaching	A_1	A dark-coloured horizon, containing a relatively high content of organic matter, but mixed with mineral matter.
		A_2	A light-coloured horizon, representing the region of maximum leaching (or reduction).
		A_3	Transitional to B, but more like A than B. Sometimes absent.
	Zone of illuviation, or deposition	B_1	Transitional to B, but more like B than A. Sometimes absent.
		B_2	A deeper coloured (usually) horizon, representing the region of maximum illuviation.
		B_3	Transitional to C.
The weathered parent material. Occasionally absent, i.e., soil building may follow weathering so closely that no weathered material that is not included in the solum is found between B and D. Horizons lettered Cc and Cs represent possible layers of accumulated calcium carbonate or calcium sulphate found in certain soils.		G	G represents the glei layer of the intrazonal soils of the humid region.
		Cc C	
		Cs	
Any stratum underneath the soil, such as hard rock or a layer of clay or sand, that is not parent material but which may have significance to the overlying soil.		D	Underlying stratum.

Note.—Important sub-divisions of the main horizons are conveniently indicated by extra numerals, thus: A_{21} and A_{22} represent sub-horizons within A_2.

Figure I.—A hypothetical soil profile having all the principal horizons. No one soil would be expected to have all these horizons well developed, but every soil has some of them. It will be noted that horizon B may or may not have an accumulation of clay. Horizons lettered Cc and G may, and usually do, appear between B_3 and C.

(From "Development and Significance of the Great Soil Groups of the United States," by Charles E. Kellog. April, 1936.)

Organic Matter and Roots. Apart from a few forested areas in the Eastern Districts, organic debris of horizons A_0 and A_{00} is absent from Rhodesian soils. The relative content of humus (decomposed organic matter) in the horizons of the solum is generally indicated by the colour of the soil: the darker the colour the higher the humus content. This is true for Rhodesian conditions, and sheet erosion in parts of the Mazoe Valley may be indicated by the bright pink or red colour of the exposed soil. The general distribution of humus in the solum, the average thickness of the horizons containing humus, infiltration of humus into the deeper horizons and any other features should be described.

As plant roots supply much of the organic material from which humus is formed, it is important to note the general distribution of roots in the soil, particularly where certain morphological features unfavourable to roots are present, such as a hard layer, or a layer containing a high concentration of salts.

Horizons. The description of the soil profile consists of a description of its various horizons. The A and B horizons (see Figure I), called the solum, represent the true soil, which is produced by soil building processes from weathered materials, and in which the biological activities take place. In some soils the separate horizons stand out conspiciously, but in most Rhodesian soils the changes are very gradual. Small samples must be removed and compared side by side in order to locate the gradational area and determine the limits of the horizons. Each horizon, including the parent material, must be described as to texture, structure, porosity, consistence and colour.

Texture. The texture of soils refers to the relative size of the individual grains, and the soil classes are recognised on the basis of the relative percentages of the different-sized particles. It is proposed that the Canadian system* be used here. Reliable identification of soil textures in the field is an art and can only be accomplished after much practice and with considerable experience. The following soil characteristics will form a rough guide:—

Heavy Clay (50 per cent. or more of clay), when wet, is very smooth and sticky. It can be pushed out between thumb and index finger into thin, narrow, shiny ribbons. It has no detectable grit. When dry, the heavy clay becomes very harsh and hard, and forms, shrinkage cracks.

Clay (30 per cent. to 50 per cent. of clay, less than 50 per cent. of sand or silt), when wet, is also sticky, but usually to lesser degrees than the heavy clay, and often a slight grit can be detected. It also forms ribbons between the fingers, but the ribbons are usually thicker. It also forms shrinkage cracks on drying and becomes harsh and hard, but not to so great an extent as the heavy clay. These properties of both soils are to a considerable extent affected by the amount of organic matter present.

Sandy Clay (over 30 per cent. clay and over 50 per cent. of sand) is somewhat less sticky and contains more sand than the clay, which gives it a gritty feel.

Silty Clay (over 30 per cent. of clay and over 50 per cent. of silt) is much smoother than the clay and not quite so sticky when wet, and more friable when dry.

Clay Loam (20 per cent. to 30 per cent. of clay and less than 50 per cent. of silt or sand) is not so sticky and smooth as the clay when wet. It does not form long ribbons between the fingers, but it can be rolled into thin stable spindles. It is somewhat gritty and when dry it does not become so harsh and hard as the clay.

Silty Clay Loam (20 per cent. to 30 per cent. of clay and over 50 per cent. of silt) is slightly smoother and softer than the clay loam. When moist it will retain the imprints of the thumb.

Sandy Clay Loam (20 per cent. to 30 per cent. of clay and over 50 per cent. of sand) is more gritty than the clay loam, but it still retains the stickiness of the latter.

Loam (less than 20 per cent. of clay and less than 50 per cent. of sand or silt) is only slightly sticky. It cannot be rolled into stable spindles, and if a ball of moist loam is dropped it will break. When dry it does not become very harsh and hard but tends to remain fairly loose and friable.

Silty Loam (less than 20 per cent. of clay and over 50 per cent. of silt) remains very smooth and soft when dry or wet. It cannot be rolled into stable spindles but it retains visible fingerprints when moist.

Sandy Loam (less than 20 per cent. of clay and over 50 per cent. of sand) possesses very little cohesion and remains friable under wet and dry conditions. It is very gritty and individual sand particles are visible.

Loamy Sand (less than 20 per cent. of silt and clay) possesses very slight cohesion.

Sand (less than 15 per cent. silt and clay) lacks cohesion and when dry it will run freely from the hand. Individual sand particles are obvious.

Structure. Soil structure refers to the manner in which individual soil grains are arranged into aggregates. Soil has a structural form in place, such as prismatic, columnar, nutlike, platy, granular, crumb or fragmental. When removed the larger aggregates may fall easily into smaller aggregates: the hardness of the aggregates and the ease with which they can be crushed is extremely variable, and soils may have a hard, medium or soft nutlike structure. The granular or nutlike aggregates may be angular, sub-angular or rounded. Each structural type description should be modified appropriately so that the hardness, size,

friability and other characteristics of the aggregates are clearly defined: the approximate size of prismatic, columnar, nutlike and granular aggregates should be given. Some of the more important structural types are as follows:—

Powdery, where the soils break up into a powdery mass when dry.

Single Grain: the individual grains do not adhere to form aggregates, as in river-sand and some sandveld.

Crumb or *Granular*, where the soil is in small firm aggregate, irregular in shape, as in the A_1 horizon of the red soils.

Nutlike: irregular shaped, slightly rounded, blocky structure, somewhat larger than granular. Found in the A_1 horizon of some vlei soils.

Prismatic: blocky structure, larger than nut, with the vertical axis longer than the horizontal. May occur in the B. horizons of vlei soils.

Columnar: prismatic, with smoother-rounded top, as in the B horizon of mopani soils.

Platy: thin, horizontal plates, often very crumbly.

Fragmental: about the same size as nut, irregularly shaped, with sharp angles and corners. Such soils are normally high in clay and low in humus.

Massive: large, uniform masses of cohesive soil, sometimes with irregular cleavage, as in the C horizons of many heavy clay soils, including vlei soils (structureless).

Laminated: not in general use, but useful to describe the B and C horizons of some heavy Rhodesian soils of impeded drainage; soil in heavy, compacted layers, with smooth faces; not vertical but normally on a slant.

Special Formations. Under this heading are included:—

(1) local concentrations and segregations of various compounds and concretions,

(2) local efflorescence of salts, and

(3) incidental morphological features.

(1) Concretions are grains or nodules of various sizes, shapes and colours, consisting of certain chemical compounds. As examples, may be mentioned the manganese concretions of the Salisbury series and the lime concretions of the black vleis. Their size and distribution must be described in full.

(2) Efflorescence refers to the occurrence of salts in crystalline form, as in the B horizons or on the surface of mopani soils.

(3) Krotovinas is the name given to irregular tubular streaks within one horizon of material from another horizon transported through rodent or root channels.

Porosity. The porosity—or the pore space and cavities in the soil mass—is very difficult to assess in the field; nevertheless, an attempt must be made to evaluate it. This, owing to shrinkage factors, should be done when the soil is at its normal moisture condition. The description should include notes regarding any observable features, such as tubular pores, intersecting fissures, and insect, worm, rodent or root channels.

Consistence. A very important property of the soil profile which must always be mentioned is consistence, which is the state of compactness of the soil in its normal state. The terms used are largely self-explanatory—loose, open; slightly, moderately or very compact; mellow; friable; crumbly; plastic; sticky; hard; and cemented. Consistence, of course, varies under different moisture conditions, so that the moisture condition at the time must be stated as well as any differences which occur under different conditions. The consistence of each horizon should be given.

Reaction. The reaction of the soil is determined accurately in the laboratory, but a very good idea of it may be obtained in the field with the B.D.H. portable tester, which should be a part of the equipment of every soil investigator. Apart from the B horizons of black vlei soil and mopani soils (it is hoped to describe these soils in a later paper), practically all Rhodesian soils are acid, the B and C horizons much more markedly so than the A. This could act as a useful guide to soil conservation officers in determining if the surface soil had been washed away. By experience the investigator will learn to associate certain vegetative types with a certain reaction. The best example of this is the mopani tree, which is always associated with an alkaline soil.

General. That disposes of those characteristics and factors of the profile which have to be enumerated and described for the purposes of identifying a soil or for describing a new series. There are, however, several other matters of very great importance, not concerned with the actual morphology of the profile, which must be reported. One of the chief of these is the *Present Land Use.* The present use of the soil, the crops grown and any other relevant facts are to be noted. It is of the utmost importance that essential differences between soil types as regards crop adaptations, yields, and appropriate practices be described. Certain soils, too, may be naturally unproductive for general or special crops, but responsive to particular types of management.

Further, since the soil is in equilibrium with all the forces of its environment, there are certain external characteristics associated with each profile, as well as the internal morphological features already described. The complete description of a soil must include a description of the relief, drainage, stoniness, native vegetation, and any special feature of the landscape.

Relief. There are four main types of relief:—

1. *Normal.* Undulating to gently-rolling upland with good but not excessive external drainage. The normal soil is associated

with this class of relief. Under the native vegetation erosion may be said to be normal.

2. *Flat Upland.* Nearly flat upland with slow external drainage. Under the native vegetation there is less than the normal erosion.

3. *Hilly.* Hills and hilly upland with extensive external drainage and more than normal erosion.

4. *Flat Lowland.* Nearly flat or depressed lowland with poor external drainage, high water table and no erosion.

The length, uniformity and nature of the slope are also important. The common comparative terms for describing relief are flat, undulating, gently rolling, rolling, strongly rolling, hilly and mountainous.

Drainage. Drainage is of two kinds, internal and external, the latter being largely a function of relief, though not altogether. Good external drainage depends to some extent on good internal drainage and vice versa. The terms used to describe drainage are poor, slow, good, free and excessive.

Stoniness. It is desirable in giving an idea of stoniness to state whether the stones are loose and can be removed or whether the stoniness is due to large stones or small outcrops.

Native Vegetation. Whenever possible the native vegetation should be described, using the scientific names, if known, and the common names of the dominant and the associated species. The characteristics of growth of the native plants should be described. The investigator should make careful observations regarding the relationship between plant associations and soil types, taking care not to attribute to the soil changes in plant relationship due to some other cause, such as excessive burning, grazing or flooding.

SAMPLING.

It will be necessary for an investigator, at some time or another, to sample the soil, an operation which must be carried out with considerable care. It is not possible to dig a pit and examine the soil profile at every given point. Some sort of correlation between the internal properties of the profile and some external features of the landscape must be arrived at. Apart from that on mopani veld the grass cover does not vary much on the different series, but careful observations will often establish a fair correlation between trees and soil. A change in tree growth will often indicate a change in the soil which is not apparent to the eye, although it is necessary to remember which is the dominant type of tree. In the Shamva area, for example, the 'mfuti tree, which is the dominant type, is the characteristic tree on the Shamva series. In the Glendale and Mazoe areas the msasa is the characteristic tree on this soil series and the 'mfuti indicates a poorer soil.

When sampling has to be done, the site for sampling must be carefully chosen. It should be representative, naturally, of the area under investigation, and should be a normal soil. The pit

must, where possible, be dug in virgin soil. In this country it is nearly always possible to find a stretch of normal, representative virgin soil, quite close to any area of cultivated land. The ground should be gently undulating, well drained and in equilibrium with the normal vegetation. Once the position has been decided a pit is dug through the solum and into the parent material. In exceptional cases this may be dug right down to the bedrock. It is better to have the pit rectangular in shape so that one wall at least may be vertical, smooth and wide enough to show the whole profile clearly. Each separate layer of the horizon must be sampled and described, and the samples must be continuous, one vertically above the other. To avoid contamination it is usually better to sample from below upwards. The soils are sampled into clean bags—about 2-3 lbs. per sample—and a ticket is enclosed giving full particulars of each sample. In view of the difficulty of identifying the various horizons in the field, they should be described in terms of their depth from the surface. In addition to the tickets enclosed in the sample bags the investigator must send in a written accurate description of the profile embracing all those factors and soil-forming characteristics, both internal and external, which have been enumerated in this paper.

SOILS OF MASHONALAND.

The soils of Rhodesia, or at all events, of Mashonaland, are extremely hard to classify in view of the fact that the soil-forming factors, climate and vegetation, play a minor part in the final nature of the soils, as compared with the original rock from which they are derived. In a small area subjected to the same climatic conditions, and under the same vegetation, will be found coarse sands from granite, red earths from greenstone, grey earths from quartzite, and brown earths from Shamva grits. The only soils which tend to uniformity, whatever the nature of the parent rocks, are the sodium soils of the arid areas, or areas of impeded drainage, and the bottom (or vlei) lands, although even here there is a difference between those formed on red earths and those formed on sands. The red earths themselves, although similar in appearance and having profiles which, on casual examination, might appear to belong to the same series, differ markedly among themselves. On analysis there are great and fundamental differences between those derived from dolerite, those derived from epidiorite and those derived from banded ironstone. This strange dependence of the soils on the parent rock, in apparent defiance of the laws of pedology, might be due to one, or a combination, of several reasons.

The most obvious, that the soil is very immature and has not had time to reach equilibrium with its surroundings, can scarcely be supported in view of the fact that many of the soils exist to a depth of at least eighteen feet above the rock from which they are derived. The second possible reason is that erosion, natural erosion which occurs to some extent under any cover during the heavy rains, may have removed slowly the critical upper layers so that the profile is in a sense immature. The third reason which might be advanced is that the alternating wet and dry seasons are responsible. The higher temperatures occur during the rainy

season—November-March—but during the dry season—April-October—the maximum temperature during the day may not be very much less than during the rains. It is possible that salts and colloids carried down from the surface layers during the rainy season are brought up to the surface again during the dry. In no sub-surface layer is there any marked layer of accumulation or illuviation, and nowhere has there been seen a water table high enough to affect the soil profile. In the soil profile of these soils there are very few morphological features; there are few horizons in the profile and the variations of the horizons are gradual rather than abrupt.

Whatever the reason for the lack of morphological features or of pedological soils types, the soils generally follow the nature of the parent rock and the geological map of an area is, with minor precautions, almost a complete guide, in the hands of a skilled observer, to the soils of that area.

Four soils from the Mazoe Valley and one from the Salisbury area will be described. They represent four main soil groups and although there are numerous variations among the types most of the soils can be classified in these terms. In conformity with the American practice the place name represents the soil series. This kind of soil, in broad classification, will be met with elsewhere in the country but the series name is given from the locality where it was first identified.

The *type* of soil is described as "sandy loam," "silt loam," etc., as the case may be; variations of type will depend on slope, erosion, cultivation, cropping and other variable factors.

The first soil to be described is of the *Shamva series* and is of considerable extent. It is derived from epidiorite and was taken on the farm Chipoli in virgin soil, under a heavy cover of grass. Trees in the vicinity are largely 'mfuti. The type is a clay so this profile represents a Shamva clay.

The profile consisted of an A_1 horizon from 0-9″, dark reddish-brown in colour, crumb to granular in structure. Below this to considerable depth (the bottom of which was not reached) was the B_2 layer of more reddish soil, of structure which was undifferentiated and can only be described as massive. The A_1 horizon was moderately compact and the B_2 horizon was friable. The soil appeared to have excellent internal drainage. Very fertile

The second soil is of the *Glendale series*, which is of about the same extent as the Shamva series. It, like the Shamva series, produces good maize. It may be distinguished from the Shamva by its lighter colour and texture. It varies in colour from brown, through pink to yellowish-brown. Soils of the Glendale series are derived from the Shamva Grits arkose, greywacke, paragneiss and conglomerate. The soil was sampled on the farm Mari Phumbi on a fairly level piece of ground under good grass. Trees in the vicinity were mainly acacia.

The soil on which the classification was made was from a sandy clay loam.

The sample consisted of a light pinkish-brown A_1 horizon from 0-7″. Texture more light and sandy than the previous series; structure small crumb, and consistence moderately compacted. Numerous roots occur in this horizon.

The B_2 horizon was more red in colour, although the change is not sharp; the texture was much the same as the A_1 horizon, as was the structure, although the crumbs were much softer. The consistence was mellow. Grass roots were numerous in this horizon down to a depth of 4′.

The third series, not very easily distinguishable in the field from the first, is known as the *Mazoe series* and it is derived from banded ironstone. It is not as extensive as the Shamva or the Glendale soils, nor, in spite of its rich appearance and heavy nature, is it so fertile. It was identified and sampled at the Mazoe Citrus Estate on gently-sloping ground on a hillside, under a rich cover of grass. The soil on which the classification was made was a heavy clay.

The profile consisted of an A_1 horizon, 0-6″, bright reddish-brown in colour, crumb to granular in structure, laced with innumerable roots and moderately compacted in consistency. At 6″ there were some round iron and manganese concretions. Below this to considerable depth was the B_2 layer of brighter reddish soil, of undifferentiated massive structure and friable consistency which increases gradually with depth to a crumbly nature. Roots persist to 3 feet. Internal drainage appeared to be excellent.

The next soil, although probably not important or widespread, has to be named in view of its prevalence in the West of the Mazoe Valley, where it considerably complicates the appearance of other soil series, and might lead to confusion of nomenclature if its nature were not understood. This is the *Tatagura series*, a very silty, grey soil derived from the quartzites, quartz- mica- and talcose schists. It was sampled on a fair slope under good grass and 'mfuti trees. The soil in this case was a silty clay.

The profile consisted of an A_1 horizon, 0-5″, grey in colour, silty in texture, structureless to crumb (on the roots) in structure, mellow in consistency. Below this to a depth of 2′, not changing abruptly at 5″ is the yellowish-grey B_2 horizon, which appears structureless, and is moderately compact in consistency. Peebles and decomposing rock occur at 2′. All soils of the series appeared shallow and somewhat immature. Moderately fertile.

The last soil is that of the *Salisbury series*, which is dominant in the Salisbury area and occurs in small patches throughout the country. It is derived from dolerite. In colour it is between the Shamva and the Mazoe series. It is red-brown, generally very deep, and very fertile. This soil was sampled on virgin land at the Agricultural Experiment Station under rich grass and 'msasa trees, on level ground. The soil as sampled here was a heavy clay.

The profile consisted of an A_1 layer, 0-8″, of red-brown, crumb-structured, fine-grained soil matted with roots; this was fairly mellow in consistency, although when wet it seemed moderately compacted. Some dark spherical manganese concretions occurred. The B_2 layer below was much redder in colour and ran from 8″-2′. Roots, both tree and grass, still numerous in this horizon. Soil fine-grained, with a tendency to crumb structure, compacted, with the maximum layer of compactness about 1′ 5″. Faint dark stainings of iron and manganese, and manganese concretions occur. Below this is the B_3 layer, undifferentiated in colour but markedly different in consistency, being crumbly. No stainings, but manganese concretions occur. Tree roots occur.

The iron and manganese stainings and concretions described for the Salisbury series may also occur in the Shamva and Mazoe series, but do not always do so. They are not considered to be indicative of any podsolisation process, though they may show a transference of the non-colloidal minerals. On water logging (a process which may occur during the heavy rains), MnO_2, with possibly Fe_2O_3, becomes soluble to some extent. On draining down through the soil the MnO_2, and possibly Fe_2O_3, is deposited. Should the descending water carrying these soluble minerals encounter concretions of $CaCO_3$ the MnO_2 would be deposited on the surface and would eventually form a concretion of MnO_2 and Fe_2O_3. (Robinson: "Soil Science," Vol. XXVII, May, 1929, No. 5.) These black concretions therefore may be regarded as indicative of former $CaCO_3$ concretions. The black shiny magnetic iron oxide which is often seen on the surface occurs in all horizons, including the bed-rock.

These black or brownish-black concretions and the surface iron oxide were analysed. Results are given in Table 1.

Table 1.

	Concretion. %	Surface Oxide. %
SiO_2	23.53	1.84
Al_2O_3	17.77	1.64
TiO_2	0.75	12.42
Fe_2O_3	21.09	—
Fe_3O_4	—	82.99
MnO_2	36.22	—

Analyses of the soils described are given in the following tables:—

TABLE 2.

SOIL	Shamva		Glendale		Mazoe		Tatagura		Salisbury	
Depth	0″—9″	9″—2′	0″—7″	1′—2′	0″—6″	6″—1′ 6″	0″—5″	5″—1′ 4″	0″—6″	6″—1′ 3″
pH	6.8	6 2	6.8	5.8	6.9	5.7	6.2	6.3	6.2	5.8
Moisture %	3.2	3.4	0.9	1 1	2 1	2.1	1.4	1.5	3.3	5.2
Loss on Ignition %	9.6	10.2	5.7	6 3	9.9	9.4	7.5	5.9	11.0	10.6
Carbon %	2.08	1.15	0.89	0.60	1.67	1.05	1.50	0.51	1.79	0.83
Nitrogen %	0.14	0.10	0.08	0.07	0.14	0.13	0.11	0.04	0.16	0.10
C/N Ratio	15.08	11.50	11.60	8.87	12.36	8.37	13.11	11.60	11.10	8.30
Total Exchangeble Bases (Mg. Equiv. %)	17.6	22.7	4.8	2.7	6.1	10.9	9.8	2.4	10.9	6.7
Exchangeable Calcium (Mg. Equiv. %)	12.6	15.5	3.2	2.0	4.0	5.9	8.2	1.7	8.3	4.6
*Exchangeable Manganese (Mg. Equiv. %)	1.4	0.71	0.52	0.27	1.56	1.2	1.04	0.45	2.55	1.74

*(Not necessarily included in Total Bases.)

TABLE 3.

SOIL	Shamva		Glendale		Mazoe		Tatagura		Salisbury	
Depth	0″—9″	9″—2′	0″—7″	1′—2′	0″—6″	6″—1′ 6″	0″—5″	5″—1′ 4″	0″—6″	6″—1′ 3″
Coarse Sand %	3.6	2.6	24.5	20.9	4.4	3 9	1.8	1 6	13.3	7.8
Fine Sand %	21.4	15.8	36.6	31.0	16.1	13.4	17.0	14 9	15 8	10.0
Silt %	34.2	29 0	9 8	9.4	25 6	24.0	42.0	41 8	14.6	11.4
Clay %	37 6	49.2	28.2	37.6	51.8	56.6	37.8	40.2	53 0	65.6
Apparent Density	1.19	1 26	1 36	1.32	1.16	1.19	1.17	1.36	1.17	1.16
Moisture Content of Saturated Soil %	51.74	47 23	33.85	37 01	48.82	48.30	45.38	36.67	52.50	55.83
Pore Space %	56.83	53 06	44 71	47 86	53 43	55 00	52 01	48.63	57.02	58.71
Specific Gravity	2.52	2.31	2.42	2.49	2 39	2.55	2.28	2.57	2.57	2.58

TABLE 4. Clay Analysis. (Top Soils only.)

SOIL	Shamva	Glendale	Mazoe	Tatagura	Salisbury
Silica (SiO_2) %	37.75	36.36	32.15	42.68	34.86
Iron Ore (Fe_2O_3) %	19.24	13 70	22.87	6.44	18 43
Titanium (TiO_2) %	1.01	1 00	0.68	0.64	0.83
Alumina (Al_2O_3) %	22.00	30.76	28.16	30.62	28.78
Silica/Alumina (Molecular Ratio)	2 91	2.01	1.94	2.37	2.12
Silica/Sesquioxide (Molecular Ratio)	1.87	1.56	1.28	2.09	1.49

REFERENCES.

*"Guide for the Selection of Agricultural Soils," by P. C. Stobbe and A. Leahey. Dominion of Canada Department of Agriculture Publication 748.

General.

"Pedology," by Jacob S. Joffe.

"Soil Survey Manual," by Charles E. Kellogg. United States Department of Agriculture Miscellaneous Publication No. 274, 1937.

"Soil Survey Manual" has been quoted extensively in the preparation of this paper.

Scheduled Diseases of Stock in Southern Rhodesia.

By The Veterinary Department.

Certain stock diseases have been gazetted in Southern Rhodesia because they are a menace to the health of man or to his stock, or they cause serious economic loss to the country if left uncontrolled.

The control and eradication of these diseases become the responsibility of the Government and its Veterinary Department. Powers and responsibilities are delegated by law to officials, owners and the general public to attain this control.

It is proposed to give a short description of the diseases scheduled and of relevant control measures such as will enable the stock owner to recognise the diseases and their dangers and appreciate their responsibilities for its control.

The following diseases are scheduled as Destructive Diseases in Southern Rhodesia under the Disease of Animals Act, Chapter 179.

African Coast Fever.
Theileriosis.
Anthrax or (Meltziekte).
Foot and Mouth Disease.
Glanders or Farcy.
Heartwater.
Lungsickness (or Contagious Pleura Pneumonia of Cattle).
Mange in Horses, Mules, Donkeys and Camels.
Pyaemia or Epizootic Lymphangitis.
Redwater.
Rinderpest.
Swine Erysipelas.
Swine Fever.
Symptomatic Anthrax (or Sponziekte) Quarter Evil.
Tuberculosis.
Scab in Sheep and Goats.
Rabies in Dogs and other animals.
Senkobo Disease.
Trypanosomiasis.
Lumpy Skin Disease of Cattle.
Contagious Vaginitis in Cows.
Contagious Epididymites in Bulls.
Contagious Abortion in Cattle.

Scheduled Destructive Poultry Diseases.

Spirochaetosis.
Coccidiosis.
Fowl Typhoid.
Bacillary White Diarrhoea.

Tuberculosis of Poultry.
Chicken Pox and Roup.
Fowl Plague in Poultry.
Newcastle Disease in Poultry.

The diseases will be dealt with more or less in the order of their importance and interest to the farmer.

Foot and Mouth Disease. This is a contagious and eruptive fever caused by an ultra visible virus. In this country it attacks cattle and occasionally sheep and pigs. Owing to conditions of climate it is more benign than the conditions met with in Europe. The disease begins suddenly and spreads with rapidity. It is rarely fatal, but causes loss of condition. It is characterised by high fever, salivation and lameness. Immediately on the rise of temperature vesicles form inside the mouth, on the tongue, gums and palate, round the coronet of the hooves and between the claws. These vesicles burst leaving raw wounds. The virus is very infectious and large numbers of in-contact cattle soon become infected. There is usually acute lameness just before and after the vesicles form and rupture. Healing soon takes place if the animals are allowed to rest and they are kept in clean surroundings. Secondary troubles are usually the result of standing in wet muddy kraals resulting in screw worm wounds on the feet.

The control of this disease in many countries is by the slaughter of all infected herds. In this Colony this is not economically practical and measures aimed at controlling the spread by breaking contact of infected cattle with clean cattle, by means of police cordons round cattle-free areas and hastening the spread of the disease through infected herds either by concentration or inoculation so as to reduce the infective period of infected herds is resorted to. The cessation of all animal movements in infected areas and large adjoining areas is essential until the possibility of spreading infection is eliminated. This also involves the control of the movement of products which may have become contaminated with infection.

The prompt reporting of suspected outbreaks is an essential in getting the disease in hand before widespread natural production of infective virus has taken place.

Movements from infected areas must be controlled sufficiently long to ensure that all infection is dead before allowing cattle on to or off the farm.

African Coast Fever. This is a tick borne disease. The beast in itself is non infectious to another animal but it carries a parasite, Theileria Parvae in its blood stream. Ths parasite is passed to another animal by an intermediate host, certain types of tick, in which the parasite undergoes developmental changes. The changes take place during the moulting period of the tick, and when next the tick attaches to a bovine these parasites set up the disease of African Coast Fever in the bovine. Brown and red ticks are the most important intermediate hosts. The parasite does not pass from the adult tick through the egg to its progeny.

The disease is characterised by a high fever with temperature as high as 108 F. Haemorrhage and ulceration of the stomach and intestines are present. Glands are swollen and characteristic infarcts of the kidneys appear. Mortality from the disease is practically 100 per cent. amongst infected animals. The control of the disease is directed against the infected ticks either by killing them by short interval dipping while on the infected animal and before they can be dropped alive to set up further cases, or secondly by removing cattle from the vicinity of infected ticks and preventing the tick having access to bovine hosts to perpetuate the disease.

The short interval dipping must be kept up as long as there is the possibility of infective ticks being on the grazing, which means a sufficently long period after the last case of African Coast Fever to be certain that all infected ticks have been eliminated. This makes it essential that *all* cattle must be dipped at short intervals and that the cause of *all* deaths is definitely diagnosed by smears for a period of approximately 18 months after the last case of African Coast Fever. Hand dressing the ears, tails clipping and dressing to destroy the ticks more inacessible to dip must supplement short interval dipping.

The control of cattle movements from infected farms and from farms on which the disease may be lying dormant is also essential and is the origin of the cattle removal permit system. Fencing of infected farms to prevent straying and the carrying of infected ticks on to clean farms is also part of the control methods. Police cordons, around the fenced infected areas, control the straying of cattle on to or from infected areas.

Theileriosis. Specific Disease. Pseudo African Coast Fever. This is a tick borne disease of cattle characterised by fever, respiratory and intestinal symptoms. The mortality is considerable and, as the gland and blood smears show parasites resembling African Coast Fever, the possibility of its being this disease has first to be eliminated.

Outbreaks in almost all cases follow a period when ticks have been plentiful. Cases are met with more often in dairy cattle, probably because of their being stabled in the vicinity of the homestead, which is usually the locality where most ticks are found and also because they oftenest miss dipping.

The disease starts with a high temperature, weeping at the eye followed by a haziness of the eyeball. In fine skinned animals a thickening and even ridging of the skin, especially on the neck, may be seen. Breathing becomes laboured with a tucked up appearance of the abdomen. The glands at the neck and flank are swollen. Constipation is present.

Post-mortem shows much fluid in the lung substance and froth in the air passages. The lung condition is the immediate cause of death. Ulceration may be seen in the stomach and intestines and there is an enlargement of the spleen. Jaundice is evident in the carcase. Owing to the state of the lungs exertion in any form must be avoided.

Control methods aim at eliminating the tick population by short interval dipping and hand dressing with quarantining to prevent the spread of infected tick. Gland and blood smears from sick animals are necessary for diagnosis.

Anthrax or Meltziekte. This is an infection disease caused by a bacillus (Bacillus Anthracis). Human beings and all animals are susceptible to the disease. The disease is sudden and very fatal, with death occurring usually within 24 hours. An animal which a short time before was grazing and appeared normal is found dead frequently with blood exuding from the nostrils and anus. The carcase teems with organisms and opening of the animal is to be avoided as it spreads the infective organisms which have the power to form resistant spores and remain viable and infective for many years. The flesh is dangerous to man and animals. For diagnosis a blood smear may be taken from the ear or tail, but as little blood as possible should be spilled, and what is spilled should be burned. The diagnostic symptoms are sudden death, black tarry blood, and if the carcase has been inadvertently opened an enlarged spleen and dark discoloured areas in the muscles are met with. An efficient vaccine is available to protect animals on infected areas. Vaccination carried out annually over a period of years protects the animals and reduces the concentration of infection which would otherwise result from a series of deaths.

Symptomatic Anthrax. Sponsziekte or Quarter Evil. This is an acute infectious disease caused by a bacillus (Bacillus Chauveii). It attacks animals, specially cattle, causing characteristic crepitating swellings of the muscles. Young animals are more susceptible than old. In cattle, fever, loss of appetite and lameness in one or more quarters are the first symptoms. The characteristic swelling of the large muscle groups develops and death usually occurs within one to three days. The mortality is practically 100 per cent. of infected cases.

On post-mortem swollen dark coloured areas of muscle full of a red gaseous fluid with a distinctly sour smell may be the only lesion. The bacilli are present in the lesion in great numbers and smears for diagnosis should be taken from such swellings. The spleen may be swollen and gas bubbles evident when cut into. The liver may be sponge-like, full of holes and with yellow areas. Smears from the yellow areas show the bacilli in large numbers. If crepitating swellings with the sour smell are present diagnosis is not difficult. Smears from swellings and the yellow areas of the liver will confirm the diagnosis. Occasionally a small dark discoloured portion of muscle or a swollen gland is all that is abnormal and the diagnosis will rest on the examination of smears from these areas. An effective vaccine for calfhood inoculation controls the disease. The infective bacilli are widespread in nature and calfhood inoculation should be a routine practice on farms.

Redwater. Pisoplasmosis of Cattle. Redwater is a disease caused by a protozoan parasite, Babesia Bovis, which is transmitted by ticks, chiefly the blue tick. The brown and red tick may also transmit the disease. The parasite attacks the

red corpuscles of the blood, breaking them down. The broken down red cells are transformed by the liver into bile which becomes excessive and the number of corpuscles broken down may be so extensive that the liver cannot cope with them and they are excreted by the kidney giving a red colour to the urine. The excess bile causes jaundice, which is seen by a yellow colour of the membranes and tissues of the animal. Animals sick from this disease run a high temperature. In Redwater areas calves acquire a calfhood immunity from an early attack of the disease. Recovered animals carry the parasite and act as carriers and infect ticks to further spread the disease.

Preventive inoculation can protect susceptible animals which have to graze redwater veld by giving them a slight attack of the disease prior to introduction to these areas. Curative treatment by means of drugs is available and the disease can be diagnosed from blood smears. Dipping controls the disease by destroying ticks, but it must be remembered that recovered animals act as a reservoir to infect further ticks. Infected blue ticks can pass the infection through the egg to a fresh generation of tick.

Heart Water. This is a tick borne disease caused by a parasite, Rickettsia Ruminatum, and transmitted by the true bont tick, Amblyomma Haebraeum and Amblyomma Variegatum. The disease affects sheep, goats and cattle. The incubation periods varies from 10-28 days. The disease is characteristic by high temperature and nervous symptoms. Dilation and rolling of the eyes, twitching of the muscles, spasmodic exaggerated movements of the limbs, walking in circles and darting in and out movements of the tongue may all be noticed. Breathing becomes laboured owing to fluid collecting in the lungs and in the heart sac. Death may occur suddenly with convulsions.

Post-mortem Symptoms. Commonly there is a collection of fluid in the peritoneal cavity. In sheep the heart sac is often distended with fluid which may or may not coagulate on exposure to air. In cattle the fluid in the heart sac is not so constant a symptom. The lungs are usually filled with fluid and froth escapes through the bronchii. Curative treatment by nitravenous injections of uleron gives fair results.

The control of the disease is by short interval dipping, five days interval at least, to cope with the bont tick, which is only on the animal for a short period. Removal of cattle to clean veld after dipping reduces the mortality, but the abandoned veld remains infective until the infected ticks have died off. The bont tick does not survive at high altitudes and the disease is a low veld dsease. Cattle and sheep are often moved to high veld during the very active tick season and the low veld grazing is utilised during the dormant tick period. Cattle moved from a Heartwater area require that they be free from bont ticks to prevent spreading the disease.

Tuberculosis. This is a contagious disease caused by the Bacillus Tuberculosis. Most species of mammals, including human being and birds, are susceptible. Cattle, particularly dairy cows,

and pigs, are most frequently affected. The onset of the disease is very insidious and the incubation period may be lengthy. At first symptoms are very indefinite and may remain so according to the site of the lesion. In advanced cases emaciation and chronic cough indicating the presence of the disease in the lungs is frequently met with. In cows lesions in the udder are common and one or more quarters may become hard and enlarged. The character of the milk changes, and infective bacilli are present. The disease may be detected during life by means of the tuberculin test. On post-mortem the carcase may show lesions in the glands and organs. The lungs, liver, kidney, spleen, uterns, udder; pleura and peritoneum being involved. The lesions in the organs are nodular like abcesses filled with a yellow cheesy material and in long standing cases the lesion may be encircled with a fibrous capsule. The lesions on the pleura and peritoneum are thickened masses of pinky white to grey red tissues resembling grapes. These lie along the ribs, the diaphragm and the serous membranes of the lungs and intestines.

The incidence of tuberculosis in the territory is low amongst animals, chiefly on account of the open range method of running cattle. Tuberculosis is always more prevalent amongst stalled animals owing to the fact that the disease is spread by inhalation of infective material from an animal suffering from the lung form of the disease. In the confined space of a stable infection is more readily picked up by in-contacts. The majority of stabled animals are milk cows, which means that the greatest infection normally occurs in milk producers.

The control of tuberculosis is based on the tuberculin test of all cattle on arrival to prevent the introduction into the country of animals suffering from the disease. The total eradication of the disease involves testing all herds with tuberculin and slaughtering all reactors, with re-tests of the herds at intervals of several months to detect new infection.

Trypanosomiasis. Nagana. Tsetse Fly Disease. This is an infectious disease of domestic animals and game caused by species of a blood parasite called a Trypanosome. The most important species are T. Congolense, T. Brucei and T. Vivax. The disease is characterised by anaemia, emaciation, lack of energy, remittent fever, swollen glands and subcutaneous oedema. The trypanosomes are transmitted to animals by the tsetse fly, in which fly they undergo stages of development. Mechanical transmission by biting flies is also possible. Game play a role in this disease as they are a natural reservoir of the trypanosomes and the chief food supply of the tsetse fly. The fly follows the game, and extension of the haunt of game means extension of the haunts of the fly. Drug treatment by means of inoculation with tartar emetic and other proprietary drugs can control the course of the disease and maintain the condition and energy of the animal, but the parasite is not entirely eliminated and the animal is prone to relapse under adverse conditions.

Eradication of the disease involves attacking the fly, its habitat and its food supply. The fly favours shady bush country and does not fly far from such places. Cutting all bush for a

certain distance prevents encroachment of the fly. Driving back the game and maintaining game fences to prevent its return starves the fly and reclaims areas from fly invasion.

Lumpy Disease of Cattle. This is an infectious disease of cattle of an urticarial nature which may be accompanied by swelling of one or more limbs or regions of the body. The cause of the disease is unknown, but it is suspected to be an insect borne, virus disease. The mortality rate is low.

Symptoms. The main feature of the disease is the appearance of very characteristic "lumps" over all or part of the body. These vary in size and in number and are easily felt by palpation as round firm swellings of the skin over which the hair becomes erected. These lumps may become necrotic and portions of the overlaying skin may slough off, or remain as hard pieces of skin from which the hair falls off. The lumps may appear by themselves or be accompanied by swelling of one or more limbs, or with swelling of the head, neck and belly. With swelling of the limbs, mummified patches of skin can often be noticed which eventually slough off leaving open sores. The normal course of the disease is about 14 days, but the skin condition remains for some time. There is considerable loss of condition and reduction of milk yields. If sloughing takes place secondary troubles result such as abscess formation and screw worm wounds. Acute cases with subcutaneous and internal haemorrhages ending in death have been encountered. The disease appears to be seasonal, subsiding with the advent of cold weather and frosts.

Control Methods. Owing to its infectious nature this disease has been gazetted in the Schedule of Destructive Diseases. To prevent spread, all movements off or through the infected farm are subject to the sanction of the Controller of Stock. Cases or suspected cases should be reported to the Veterinary Department.

Contagious Vaginitis and Contagious Epididymitis. This is a contagious venereal disease of cattle affecting breeding cows ond bulls. The cause of the disease is unknown. In the bull the disease causes enlargement of the testicles, especially of the epididymis, and eventual loss of function. In the cow an inflammation of the vagina in the vicinity of the cervix occurs causing a vaginal discharge. The condition in the cow prevents conception and the cow keeps on returning to the bull. The bull infects the cows and infected cows can infect the bull at coitus. The disease is very insidious. The first suspicions may be cows failing to hold to the bull and returning for repeated service, or the shape of the testicles of the bulls may be noticed to be abnormal. Palpation of the testicles will disclose a hardening and enlarging of the tissues, especially of the epidymis, which may increase to the size of a cricket ball and larger than the main body of the testicle.

Control Methods. In the bull there is no treatment available. Once infected the disease destroys the testicles and in attempting service the bull can disseminate the disease. Immediate slaughter is the only means of controlling the spread of the disease by bulls. In cows vaginal irrigation with iodine solution with no

access to bulls until the local condition has cleared up has been resorted to. Artificial insemination has been practised in one territory to prevent dissemination of the disease and to maintain breeding.

Contagious Abortion in Cattle. This is a contagious disease of cattle caused by a bacteria, Bacillus Abortus, which gains access to the womb and causes abortion.

Symptoms. There are no general symptoms seen. Abortion may result suddenly and be even unnoticed. A secondary result may be a retained afterbirth, and in herds where retained afterbirths are frequent, Contagious Abortion should be suspected. A cow once infected may abort as many as three times, but usually only once. Subsequent calves may be weakly. Cows may become sterile.

Control Methods. The infected animal may be detected by blood test. Blood is collected in small tubes containing preservative and forwarded for a laboratory test. In infected herds calfhood inoculation with Strain 19 Contagious Abortion Vaccine and repeating the inoculation after the first calving is claimed to clear the infection in a herd. All fresh introductions to a clean herd should be made on negative blood test.

If possible infected cows should be separated from clean cows, especially during calving, and for about three weeks after, as it is during this period that the womb discharge spreads the disease by contaminating the pasture or food materials. Cows become infected by eating such contaminated material. Infected cows may secret bacillus abortus in their milk and cases of Undulant or Malta Fever in humans may occur from drinking such milk.

Dourine. This is a disease of equines caused by a trypanosome (T. Equiperdum) which is transmitted from animal to animal during the sexual act. It is characterised by swelling and inflammation of the external genital parts in both sexes with discharges. The swellings appear a week to a month or longer after copulation. This is followed by sharply defined swellings on the skin on various parts of the body, which disappear in a few days to be followed by a further crop. Nervous symptoms such as inco-ordinated movements, unsteady gait and partial paralysis of the lips, nostrils and hindquarters develop. Emaciation generally follows. The disease is chronic and deaths occur from six months to two years after infection. The disease can be detected by a serum test which is used to prevent the introduction of infected animals into clean areas. As the disease is transmitted by coitus the prevention of breeding by infected animals controls the disease.

Rabies. Hydrophobia. This is an infectious inoculable disease caused by an ultra visible virus. All animals, including human beings, are susceptible, but the dog is the main spreader of the disease. The disease is characterised by symptoms of madness and later paralysis. The affected dog changes its normal disposition. It becomes restless, hides away and wanders in an aimless manner. It snaps at persons, animals and objects. It may foam at the mouth and tear up and swallow all manner

of things. It may go on the run and proceed for amazing distances snapping dangerously at people, animals and objects. The bark changes to a howl. Paralysis sets in and the jaw drops. Saliva trickles from the mouth owing to inability to swallow. The saliva is infectious and can infect by being inoculated into the body by a bite from the rabid dog or if saliva enters the body by way of a scratch. The route of infection through the body is by the nervous system.

Post-mortem symptoms are not constant. The stomach may contain an assortment of foreign material swallowed by the animal. The brain of a dog dead from rabies or destroyed on suspicion is examined for "negri bodies" or brain substance is inoculated into laboratory animals to confirm the diagnosis. The dog, through his close domestic contact with human beings and animals, is the most dangerous spreader of the disease, but species of wild cat act as reservoirs of infection and spreaders of the disease in countries where these animals exist.

The control of the disease is by control of the entry of all dogs into the territory. When an outbreak occurs all stray dogs should be destroyed and muzzling and restraint exercised on others. It is important to diagnose the disease in suspected animals which have bitten people in order that curative treatment may be commenced as early as possible. Curative treatment for humans developed on the lines of Pasteur's work with neurotropic virus standardised and attentuated is available. It is essential that all suspected cases be treated before the natural virus has established itself in the nervous system.

Scab (Sheep). Mange. This is a disease caused by small insect parasites known as acari. Three forms are known. Psoroptic Scab, Sarcoptic Scab and Symbiotic or Chorioptic Scab caused by particular species of acari. All three are characterised by scab covered sores. The skin underlying the scabs is underrun by channels in which the insects have burrowed, mated and laid eggs which hatch out in the channels. The first symptoms noticed are the sheep rub themselves against fixed objects breaking off the wool and causing sores. The skin under the wool is inflamed. Small pimples form from which a thick serum exudes to form a crust or scab. The area of the scab increases and spreads to other parts of the body. Great itching and uneasiness result and untreated sheep become emaciated and die.

Psoroptic Scab occurs on the less woolly part, but spreads to other parts.

Sarcoptic Scab occurs on the head, ears and tail.

Symbiotic or Chorioptic Scab appears usually about the pastern and coronets.

The disease can be diagnosed by taking scrapings from the sores and examining under a miscroscope or a good hand lens for the insects. The disease is controlled by dipping. In sheep rearing countries double dipping, two dippings at an interval of between 7-14 days, in approved dips of scheduled strength, is compulsory. The parasite soon dies if prevented from reaching a host so that infected premises are rendered safe after a period

of quarantine and freedom from sheep. Infected flocks are quarantined and no movement allowed until after dipping, and on inspection found free from the disease.

Mange on Horses, Mules and Donkeys. This is a disease of the skin caused by small insect parasites known as acari The disease is similar to scab in sheep, but is caused by different varieties of acari. The Psoroptic and the Sarcoptic types are the most important in equines, the Symbiotic type not coming under the scope of the regulations. Sarcoptic and Psoroptic mange usually appears on parts of the body to which harness is applied, but spreads to other parts. The first symptoms are rubbing and biting, pimples and scabs appear. The hair falls out. If neglected the skin becomes hard and ridged. The animal becomes emaciated and may die. Symbiotic mange appears at the root of the tail and the lower parts of the legs. Diagnosis is made from scrapings from the pustular sores and finding the parasites present. Harness and grooming equipment are the commonest means by which the parasites are spread from one equine to another. The control of the disease is by means of isolation of infected animals, disinfection of premises and equipment and treatment of infected cases by dipping or dressing with insecticide preparations.

Rinderpest. Cattle Plague. Rinderpest is a contagious disease of cattle, attacking also various species of game, and is caused by an ultra visible virus. The disease spreads rapidly. It gives rise to fever, haemorrhage and ulceration of the mucous membranes, especially of the digestive track, causing sores in the mouth, stomach and intestines. Blood stained diarrhoea results. Eruptive sores can only be seen on the skin on different parts of the body. The sores on the mouth and nostrils become covered with diphtheric membranes. The disease spreads rapidly and mortality in fresh outbreaks may be over 90 per cent. Effective methods of virus and serum inoculations have been evolved and used in countries where the disease exists. Control methods are based on a passive immunisation of cattle surrounding an infected area and quarantine and slaughter in the infected area when the disease makes a first appearance. Game play a role in the spread of the disease, and in a quarantine area their destruction or enclosing within the area must be considered. The disease has not appeared in this territory for over forty years, but as it is enzootic in parts of Africa there is an ever-present danger of its reappearance or introduction.

Lung Sickness. Pleuro Pneumonia. This is a contagious disease of cattle characterised by inflammation of the lungs and pleurisy. It is caused by a minute organism (Asterococcus Mycoides) present in the exudate from the diseased lung. The disease is transmitted by inhalation from direct contact with an infected animal. The incubation period is 1-4 weeks and the early stages are often not noticed. Infected animals develop a cough with painful breathing and great emaciation occurs. The condition of the animal may improve after the acute stage, but such recovered animals known as "lungers" may be infective and spread the disease by contact with susceptible animals.

On post-mortem the lungs show pleurisy and may be fixed to the chest wall by a yellowish membrane. The lobules of the lungs are separated by thickened areas of yellow fibrous tissues. Encapsuled dead areas of the lung may be seen. The disease was eradicated from this territory, but it is present in adjoining territories. The introduction of the disease is controlled by veterinary examination of all cattle before entry from countries in which the disease exists. It is considered that the disease was eradicated from this territory when African Coast Fever swept the country and killed off all the "lungers." The official method of control at that time was based on the destruction of all infected animals and the inoculation of all in-contacts.

Glanders or Farcy. This is a contagious disease caused by the Bacillus Mallei. It attacks equines principally. It is called Farcy when sores are located on the surface of the body or limbs and Glanders when the symptoms are seen in the nostrils, submaxillary glands and lungs. In Farcy one or more legs may be swollen with ulcerating nodules along the course of the enlarged lympatic vessels. In Glanders there is a thick grey discharge from one or both nostrils and ulceration may be seen inside these The glands under the jaw are enlarged and hard. In severe cases the temperature is raised and respiratory symptoms are evident. In chronic cases the temperature may stay round normal.

The post-mortem appearance of Glanders is of numerous small grey nodules throughout the lung substance with ulceration of the air passages. The diagnosis of Glanders is confirmed by submitting the animal to the Mallein Test. The control of the disease is by preventing the introduction of diseased animals by testing all importations with Mallein. The disease has been successfully eradicated from the territory, which makes Mallein Testing on entry of all equines very important.

Epizootic Lymphangitis. This is a chronic disease affecting principally equines and is caused by a parasite known as Cryptococcus Farciminosus. The disease is characterised by purulent inflammation of the cutaneous and subcutaneous lymph glands with the formation of abscesses in the glands. The incubation period may be prolonged to several months. Nodules appear on the skin which break down and ulcerate. The lymph vessels in the vicinity become cord-like and further nodules form along the course of their vessels. The temperature remains normal and appetite is maintained. The condition is mainly cutaneous and chronic and resistant to treatment. It resembles Farcy, but is differentiated by the specific parasites and non-reaction to Mallein. This disease has been successfully eradicated from the territory. Control methods demand examination of all imported equines to prevent reintroduction of the disease.

Swine Fever. This is a contagious eruptive disease of swine caused by an ultra visible virus. The disease in acute cases commences with a high temperature and quickened breathing. The pigs lose control of their hindquarters and stagger about when made to walk. A red rash turning to purple appears on the skin at the base of the tail, under the belly, inside the thighs

and on the ears. Death in these cases generally occurs in about three days. In the more chronic cases the symptoms show up more slowly. The pigs run a high temperature, are dull and not inclined to move about. They go off their food and may vomit. Constipation is followed by blood stained diarrhoea. Red patches turning to purple appear as in the acute cases. Lung trouble, including a cough and laboured breathing, may occur. Deaths usually occur within one to three weeks. Recovered animals are very emaciated.

On post-mortem the carcase shows emaciation and livid skin patches. Haemorrhage, swollen glands, thickened bowel walls are evident. Where the disease has dragged on for some time ulceration on the tongue, stomach and intestines are present, a particular site being the region of the junction of the ileum and caecum. In many cases the lungs are severely affected showing haemorrhage, pneumonia, and necrosis.

Diagnosis. Clinical symptoms vary so much that these may not be sufficient for diagnosis. Usually several post-mortems have to be made. Fever associated with haemorrhages of the skin, with ulceration and formation of deposits on the mucous membrane of the mouth and throat usually are suggestive. These confirmed with pneumonia and ulceration and thickening of the bowels and the extent of the outbreak usually establish the diagnosis. The disease does not exist in the territory. Control methods demand that importations of swine be certified to originate from areas in which swine fever has been absent for twelve months or more, in order to prevent introduction of the disease.

Swine Erysipelas. This is an infectious disease of swine caused by a bacillus (Erysipelothrix Rhusiopathiae). It is characterised by fever, discolouration of the skin, internal haemorrhages and in long standing cases with wart-like growths on the valves of the heart. The disease is met with in acute, sub-acute and chronic forms. In acute forms areas of the skin, on the ears, neck, shoulder, back, buttock and thighs show raised diamond-shaped patches red to purple in colour. These patches may run together to form irregular masses. The disease in the acute form is rapidly fatal and about 80 per cent. of cases succumb. In sub-acute and chronic cases, fever, skin rash and lameness are evident. The carcases of acute cases show an intense red discolouration throughout due to internal haemorrhages. In chronic and sub-acute cases the rash may wear off, but the skin may show sloughs where the rash appeared. A characteristic lesion on the valves of the heart is met with in long standing cases and resembles soft wards. The disease is not present in this territory. Control measures aim at preventing the introduction of infected animals by means of veterinary inspection and certification before arrival and inspection on arrival. Immune serum can protect in-contacts.

Senkobo Skin Disease. This is a skin disease of cattle considered to be caused by the Bont Tick (Amblyomma Haebraeum). It is characterised by skin eruptions usually commencing on the less hairy parts of the body and then gradually

extending to other parts, particularly the back. The disease has so far only been found in areas where the bont tick is present. To obtain results by curative treatment it is essential to commence in the early stages and paraffin applications appear to give the best results. The control of the disease aims at destroying the bont tick by hand dressing and short interval dipping.

SCHEDULED POULTRY DISEASES.

Spirochaetosis. This is a blood disease of poultry caused by a spirochaete (*Spirochaete Gallinarum*) transmitted by the fowl tick (*Argus Persicas*).

The onset is sudden. Birds apparently healthy the night before are found dead in the morning under the perches. There is dullness, ruffled feathers, loss of appetite, diarrhoea, emaciation and death. The parasites are found in large numbers in the blood.

The control of the disease is destruction of ticks in the poultry houses and runs.

The tick is a soft bodied tick resembling the Tampan and in many cases is referred to as the Tampan. The larval stages may be found commonly under the wing and are then only about a tenth of an inch long. In the nymphal and adult stages the tick usually attaches for a short period, usually at night when the birds are roosting and then they detach and hide in cracks of the wood and brick work during the day. The spirochaete can be seen in blood smears from infected fowls.

Control methods rely upon the destruction of the fowl ticks in the premises by periodic spraying with an insecticide.

Coccidiosis of Poultry. This is a disease of poultry caused by a (*Coccidium Avium*) which gives rise to an enteritis with heavy mortality.

Parasites are passed in the droppings of infected birds. These are picked up by other birds and the encysted parasite on reaching the intestine liberates several forms which enter the cells of the intestinal wall. Development takes place with large increase in the number of parasites which cause great damage to the intestines resulting in acute diarrhoea which may be streaked with blood. Parasites are passed out with the faeces to infect other birds.

The disease develops and spreads rapidly with heavy losses. It eventually becomes chronic in the remainder of the flock. Affected birds lose appetite, become droopy and emaciated. The vents are solid with a pasty white diarrhoea which may be tinged with blood. Leg weakness, paralysis and death follows. The parasites can be detected in the droppings of infected birds by microscopic examination.

Tuberculosis of Poultry. There is an infectious disease of poultry caused by the Bacillus Tuberculosis. Not only is the disease destructive to poultry flocks, but it is often the source of spread to other animals on the farm and a danger to human beings, especially those managing the flock.

The disease is slow going and chronic. Deaths may not occur until the disease is well established and deaths, which are usually the outcome of emaciation, may be so sporadic as to be accepted as normal and mask the disease.

The only symptoms noted may be loss of weight and emaciation. Post-mortem usually reveals pearly gray white nodules in the liver, spleen, ovaries, lungs and on the peritoneum varying from pin head size to that of a pea.

The disease may be diagnosed by testing with Avian Tuberculin.

Bacillary White Diarrhoea. This is a disease of baby chickens caused by a bacillus (*Salmonella Pullorum*) which gives rise to a white or whitish brown frothy diarrhoea. It is very fatal and causes heavy losses in young poultry.

The egg from infected hens may contain the bacteria and chickens are born with the disease, which rapidly spreads amongst the newly hatched chicks. Infected chicks are sleepy and dull.

The frothy diarrhoea is the most prominent symptom. Mortality may be as high as 75 per cent. Recovered birds do not make good weight and hens harbour the bacilli in the ovaries to infect the eggs.

Infected birds can be detected by a serum test.

Fowl Typhoid. This is a disease of poultry caused by a bacteria *Salmonella Gallinarum.*

The disease commences with diarrhoea of a greenish yellow colour. There is loss of appetite, thirst, drowsiness, diarrhoea, emaciation and death.

The disease is rapidly fatal. The bacteria can be isolated from the blood of the bird. Post-mortem shows intestinal catarrh and small haemorrhages of the mucous membranes.

The liver is congested and has a characteristic bronze appearance. There may be grey necrotic patches on the liver.

The disease is spread by birds from an infected flock being introduced. Infection can be passed through the egg and young infected chicks hatched out.

The droppings of infected fowls and dead carcases are sources of further infection.

There is a prophylactic vaccine available. Vaccination, sanitary measures and curative serum injections can control an outbreak.

Chicken Pox and Roup. These diseases are caused by an ultra visible virus. The two conditions are often met with together and controversy exists as to whether they are not the same disease and caused by one or two viruses which owing to the nature of virus cannot be separated.

CHICKEN POX is characterised by typical scab like sores on the wattles, comb and face varying from the size of a pin head to a pea resulting from original pimples which have

ulcerated. The virus which spreads the disease is contained in these sores and on contact with the broken skin of susceptible birds can set up the disease. Usually combs, which are easily injured, are the main seat of sores. Infection can also be spread by blood sucking insects biting an infected fowl and these are capable of transmitting the disease for 14 days afterwards.

The severity of the disease varies from season to season and mortality may be from 5 to 70 per cent.

A Chicken Pox vaccine is available for the protection of poultry.

ROUP. This disease is caused by an ultra visible virus. The characteristic of the disease is catarrhal condition of the nose with an offensive discharge. This discharge at first watery becomes purulent and evil smelling and blocks the nasal passages showing swellings under the eye.

Nasal Roup may appear by itself in a flock, but it is commonly accompanied by Diphtheritic Roup in which sores appear in the mouth. These sores are covered with a yellowy white cheesy mass overlaying an ulcerated surface.

Fowls suffering from Chicken Pox and Roup should be isolated from the rest of the flock. Individual treatment is seldom worth while, but sores may be scraped clean and dressed with Silver Nitrate or Tincture of Iodine and the nasal passages drained and dressed.

Fowl Plague is an acute highly infectious disease of fowls caused by a virus which is highly fatal.

Symptoms. It appears suddenly and chickens may die without showing any symptoms. Birds appear weak and inclined to stay in one place. They appear dull and listless with ruffled feathers, refusing food and finally staggering before death. The combs and wattles become dark red or blackish. There is often swelling of the head and throat with a discharge of mucus or blood stained exudate. Finally there is difficulty in raising the head from the ground and the birds become comatose and die usually within a couple of days. On post-mortem the most characteristic lesion is haemorrhages on the surface of the crop and gizzard.

Control Methods. Fowl Plague is the most fatal disease of poultry, and destruction of infected flocks and disinfecting of premises and equipment is the usual method of preventing infected birds spreading the disease to other flocks.

Newcastle Disease is an affection of poultry closely resembling Fowl Plague and also caused by a virus.

Symptoms. The condition is almost indistinguishable from Fowl Plague, except that it is not so acute and the incubation period (7 days or more) and the course of the disease is longer. The disease is more highly contagious than Fowl Plague. The mortality is very high and the disease is sometimes called Pseudo Fowl Plague.

Control Methods. These are similar to methods adopted for Fowl Plague.

Rhodesian Milk Records.

OFFICIAL MILK RECORDS.

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Matopo Tulip	P.B. Red Poll ...	Senr. 3 year	4688.90	162.81	3.47	300	Govt. Experimental Station, P.B. 19K, Bulawayo.
Matopo Queenly ...	P.B. Red Poll ...	Mature	6298.00	249.06	3.95	285	
Matopo Quereen ...	P.B. Red Poll ...	Mature	5812.40	226.05	3.89	300	
Matopo Sunbeam ..	P.B. Red Poll ...	Junr. 4 year	4519.10	148.73	3.29	289	
Albert Vale Spiegel Van N. 6/193	Friesland	Mature	11851.00	446.05	3.77	300	J Jamieson, Box 217, Bulawayo.
Gouwsplant Jantje II	Friesland	Junr. 3 year	10321.00	378.55	3.67	300	
Albert Vale Spinnekop XXX.... ...	Friesland	Mature	18026.00	633.04	3.51	300	
Fairseat Rose	Jersey	2 year old	2833.00	153.24	5.41	300	J. H. Keightley, Moorfield, Glendale.
Meadow's Gift IV.	Jersey	2 year old	2906.50	156.55	5.30	270	
Meadow's Pioneer Wallflower	Jersey	2 year old	4161.50	248.63	5.97	300	
Colonies Plaats Jeltje V.	Friesland	Mature	5844.00	212.99	3.64	300	Meikles Trust, Ltd., Leachdale Farm, Shangani.
Goschen Rose	Friesland	Mature	10831.00	363.98	3.36	300	
Leachdale Bactrina	Friesland	Mature	8986.00	338.21	3.76	300	
Sevenfontein Syringa	Friesland	Mature	9236.00	286.51	3.10	300	
Albert Vale Andre Van N.6/216	Friesland	Mature	7726.50	279.79	3.62	300	T. C. Pascoe, Crowborough Estate, Box 1253, Salisbury.
Albert Vale Andre Van N.6/333	Friesland	Junr. 3 year	9336.00	282.97	3.03	300	
Albert Vale Andre Van N.6/334	Friesland	Junr. 3 year	7829.00	255.50	3.26	300	
Albert Vale Bokwagen Van N.6/222	Friesland	Mature	7828.00	275.14	3.51	300	
Albert Vale Bokwagen Van N.6/343	Friesland	Junr. 3 year	9286.00	314.46	3.39	300	

Albert Vale Bokwagon Van N6/349	Friesland	2 year old	6701.50	223.51	3.34	300	
Albert Vale Spinnekop Van N.6/350	Friesland	2 year old	7766.50	287.96	3.71	300	
Albert Vale Umtini Van N.6/366	Friesland	2 year old	7525.50	230.65	3.06	300	
Bluff Hill Felicity II....	Friesland	Senr. 4 year	5466.50	190.93	3.49	280	
Albert Vale Vleermuis XIII.	Friesland	Mature	9795.00	323.42	3.30	300	
Whinburn Aconite	Friesland	2 year old	6879.80	266.50	3.87	300	R. R. Sharp, Whinburn, Redbank, Bulawayo.
Whinburn Alouette	Friesland	2 years	5589.60	217.41	3.90	300	
Whinburn Barbet	Friesland	Senr. 3 year	6916.30	247.39	3 58	300	
Whinburn Gavotte	Friesland	Mature	8464 00	292.94	3.46	300	
Whinburn Lark ...	Friesland	Junr. 3 year	7737.00	258.67	3.34	300	
Whinburn Nougat	Friesland	Mature	14079.10	459.56	3.26	300	
Whinburn Amazon	Friesland	2 year old	6567.00	241.34	3.67	300	
Whinburn Cinnamon	Friesland	Senr. 4 year	8418.30	306.48	3.64	300	
Whinburn Peppermint...	Friesland	Mature	7864.60	273.18	3.47	300	

SEMI-OFFICIAL MILK RECORDS.

Dolly	G. Friesland	Mature	6894.40	238.32	3 46	300	D. A. Allan, Pendennis Farm, Avondale
Nawton	G. Friesland	Mature	6319 00	234.34	3.71	300	
Byisu	G. Friesland	Mature	7811.30	286.75	3.67	300	
Blossom	G. Friesland	4 years	6888.00	234.55	3.41	300	R. A. Ballantyne, Box 801, Salisbury.
Chidakwa I.	G. Shorthorn... ...	Mature	7027.30	262.78	3.74	300	J. H. Barry, Box 209, Umtali.
Chamois	G. Shorthorn... ...	2 years	4662.80	230.00	4.93	300	
Daisy I.	G. Shorthorn... ...	4 years	6156.10	289.69	4.71	300	
Dairy I.	G. Shorthorn... ...	Mature	6531.40	266.61	4 08	300	
Jolly II.	G. Afrikander ...	Mature	6589.10	327.57	4.97	300	
Moira	G. Shorthorn... ...	Mature	6771 20	294.58	4.35	300	
Flaky II....	G. Shorthorn... ...	Mature	5784.90	232.81	4.02	300	
Dolly	G. Shorthorn... ...	Mature	7320.90	295.48	4.04	300	
Queen II.	G. Shorthorn... ...	Mature	8112.70	347.73	4.29	300	

SEMI-OFFICIAL.—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Aussie-White	G. Friesland	Mature	6699.70	250.80	3.74	300	J. A. Baxter, Box 1368, Salisbury.
Bulawayo	G. Friesland	Mature	10169.00	311.24	3.06	300	
Charlie Vee...	G. Friesland	Mature	6856 40	311.44	4.54	300	
Chemminnie III....	G. Friesland	Mature	4919.00	240.80	4.90	263	
Chimit C. 30	G. Friesland	Mature	8192.20	275.25	3.36	300	
Clacupar Panica Pen	P.B. Friesland ...	Mature	7896.70	287.10	3.64	300	
Convoy	G. Friesland	Mature	8221.80	301.02	3.66	300	
Crisman	G. Friesland	Mature	6866.80	273.14	3.98	300	
Dop	G. Friesland	3 years	6362.50	262.52	4.13	300	
Ice Cream	G. Friesland	Mature	10981.20	350.76	3.19	300	
Lawyer	G. Friesland	4 years	7709.20	257.26	3.34	300	
Lumpy...	G. Friesland	Mature	9213.50	353.12	3.83	300	
Mabel	G. Friesland	Mature	7960.20	318.23	4.00	300	
Makaba	G. Friesland	Mature	6080.10	280.38	4.61	300	
Maria	G. Friesland	Mature	6872.10	228.64	3.33	300	
Mother	G. Friesland	Mature	9289.40	363.76	3.92	300	
Mupalange	G. Friesland	3 years	6262 20	232.42	3.71	300	
Soap	G. Friesland	Mature	6325.30	289.97	4.58	300	
Wellington	G. Friesland	Mature	9675.00	292.00	3.02	300	
Window	G. Friesland	Mature	10048.30	348.73	3.33	300	
D 58	G. Friesland	Mature	9347.30	360.02	3.85	300	A. L. Bickle, Box 595, Bulawayo.
D 44	G. Friesland	Mature	11065.50	388.00	3.51	300	
J 44	G. Friesland	Mature	7141.10	258.88	3 62	300	
D 52	G. Friesland	Mature	7417.60	278.55	3.76	300	
D 48	G. Friesland	Mature	9373.40	359.61	3.84	300	
D 127	G. Friesland	3 years	7259.40	263.38	3.63	300	
D 96	G. Friesland	Mature	9646.80	342.82	3.55	300	
D 27	G. Friesland	Mature	8635.10	278.21	3.22	300	
J 59	G. Friesland	Mature	9181.30	431.82	4.70	300	
D 59	G. Friesland	Mature	8035 50	259.85	3.23	300	
D 2	G. Friesland	Mature	6497 70	293.44	4.52	300	
D 49	G. Friesland	Mature	10692.10	404.34	3.78	300	
D 45	G. Friesland	Mature	8003.20	303.59	3.79	300	
Jutice	G. Friesland	Mature	6902.70	270.43	3.92	254	Mrs. D. Black, Burnside, Bindura
Marty...	G. Friesland	4 years	6624.50	252.92	3.82	300	

Dirko Jessie	P.B. Friesland ...	Mature	10395.00	387.82	3.58	300	C. Boyd Clark, Castle Zonga, Inyazura
Dirko Swart Kapel	P.B. Friesland ...	Mature	6736.00	241.26	3.58	300	
Truant III....	G. Friesland	Mature	7497.00	266.31	3.55	238	
No. 205...	G. Friesland	4 years	5955.00	227.79	3.83	300	
No. 195	G. Friesland	4 years	7990.00	307.87	3.85	292	
No. 98	G. Friesland	Mature	6427.00	235.43	3.66	235	
Betty	G. Guernsey... ...	3 years	5958.00	249.99	4.19	291	Miss N. Brereton, Coolmoreen, Gwelo.
Jettie	G. Fries./Guern.	Mature	5638.20	225.05	3.99	300	D. L. Cameron, Lochiel, Fort Victoria.
Philippa	G. Friesland	Mature	7415 00	239.17	3.22	300	Christo & Wilson, Box 110, Gwelo.
Felice	G. Friesland	Mature	7039 00	261.34	3 71	300	
No. 282...	G. Friesland	Mature	7620.00	233.61	3.06	300	
Hoppity	G. Ayrshire	3 years	6304.40	265.12	4.20	300	R. Jackson Clarke, Kingston Farm, Gwelo.
Sunbeam...	G. Ayr./Fries. ...	Mature	6139.70	233.44	3.80	300	
Rita	G. Ayrshire	Mature	7679.80	274.56	3.57	272	
Isabel	G. Friesland	Mature	7539.40	334.56	4.44	283	
Sunnyside II.	G. Friesland	Mature	7248.30	259.94	3 59	300	
Aiass	G. Ayrshire	4 years	6189.50	266.96	4 31	290	
Sylvia	G. Ayrshire	3 years	6488 80	253.64	3.91	300	
Iris	G. Ayrshire	Mature	6019.90	234.91	3.90	244	
Duchess	G. Friesland	Mature	7838.90	259.33	3.31	300	
Allannah	G. Ayrshire	Mature	7150.60	310.92	4.35	300	
Grima	G. Friesland	Mature	5409.00	242.78	4.49	300	J. Cumming, Hillside Farm, P.O. Norton.
Seriman Hillside I.	G. Friesland	Mature	6290.00	246.93	3.93	300	
Sinoia	G. Friesland	Mature	7189.50	261.83	3.64	300	
Hores	G. Friesland	Mature	7179.00	241.46	3.36	300	
Maria Hillside... ..	G. Friesland	Mature	6407.00	275.79	4.30	266	
Blake	G. Friesland	Mature	6538.00	235.61	3.60	246	
Jeanette	G. Friesland	3 years	7069.00	275.13	3.89	300	A. C. De Olano, Bluewater Farm, Bromley.
Organdie II.	G. Friesland	4 years	6222.00	259.47	4.17	300	
Pillow II.	G. Friesland	4 years	7519.00	313.61	4.17	300	
Porky III.	G. Friesland	4 years	7316.00	298.04	4.08	300	
No. 90	G. Friesland	Mature	6272.30	236.28	3.77	300	J. B. Dold, Box 1153, Salisbury.
A 123	G. Friesland	Mature	6954.80	257.57	3.70	300	
R 152	G. Friesland	3 years	8211.50	262.83	3.20	300	
R 163	G. Friesland	3 years	6335.20	231.65	3.66	300	
Zonga Queen III.	P.B. Friesland ...	Mature	5797.00	245.53	4.24	283	Mrs. M. Everard, Castle Zonga, Inyazura.

SEMI-OFFICIAL.—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
No. 278	G. Friesland	Mature	7588.50	273.27	3.60	300	H. C. Fischer, Olivia Farm, Headlands.
No. 208	G. Friesland	Mature	6214.50	232.95	3.75	300	
No. 100	G. Friesland	2 years	7356.00	282.35	3.84	279	R. le S. Fischer, Wakefield, Headlands.
No. 113	G. Friesland	2 years	7464.00	250.05	3.35	277	
No. 117	G. Friesland	2 years	7873.00	290.63	3.69	300	
No. 127	G. Friesland	2 years	6815.00	228.64	3.35	253	
No. 202	G. Friesland	Mature	10447.00	343.77	3.29	274	
No. 166	G. Friesland	Mature	9724.00	323.46	3.33	292	
No. 163	G. Friesland	Mature	8577.00	305.42	3.56	286	
No. 161	G. Friesland	Mature	10616 00	354.25	3.34	280	
No. 169	G. Friesland	Mature	9807.00	360.15	3.67	300	
No. 170 Poppy	G. Friesland	Mature	8015.00	272.09	3.39	300	
No. 168	G. Friesland	Mature	7146.00	256.82	3.59	300	
No. 72	G. Friesland	3 years	8138.00	326.94	4.02	300	
No. 44	G. Friesland	Mature	7735.00	252.12	3.26	300	
No. 34	G. Friesland	4 years	11076.00	337.38	3 31	300	
No. 71	G. Friesland	2 years	7390.00	241.64	3.27	300	
No. 82	G. Friesland	2 years	8862.00	290.57	3.28	300	
No. 6	G. Friesland	Mature	9774.00	340.34	3.48	279	
No. 132	G. Friesland	Mature	7749.00	249.81	3.22	277	
No. 37	G. Friesland	Mature	6322.00	246.85	3.90	300	
No. 144	G. Friesland	Mature	8382.00	276.56	3.30	300	
No. 33	G. Friesland	4 years	9114 00	282.47	3.10	299	
No. 67	G. Friesland	3 years	8133.00	266.94	3.28	300	
No. 59	G. Friesland	3 years	11049.00	343.40	3.11	300	
No. 10	G. Friesland	Mature	8351.00	260.10	3.11	300	
No. 51	G. Friesland	4 years	8043.00	283.17	3.52	267	
No. 85	G. Friesland	3 years	6620.00	228.55	3.45	267	
No. 503	G. Friesland	3 years	6582.50	229.58	3.49	300	W. F. Fischer, Coldstream Dairy, Headlands.
No. 432	G. Friesland	Mature	6319.50	228.35	3 61	300	
No. 500	G. Friesland	3 years	7334.50	261.34	3.56	290	
Marion	G. Friesland	Mature	6937.00	237.16	3.42	300	
No. 499	G. Friesland	3 years	6011.50	262.96	4.37	272	
No. 8A	G. Friesland	Mature	6566.50	244.46	3.72	276	
No. 326	G. Friesland	Mature	7062.00	225.78	3.20	272	

No. 12A	G. Friesland	Mature	7174 00	234.50	3.27	271	
No. 361	G. Friesland	Mature	7127 00	229 68	3.22	300	
No. 377	G. Friesland	Mature	6887.50	238.99	3.47	300	
No. 403	G. Friesland	Mature	8686.00	302.67	3.48	300	
Holland	G. Friesland	Mature	8854.60	392.37	4.43	300	G. J. Franklin & Son, Box 105, Umtali.
Donkey	G. Friesland	4 years	6847.20	247.97	3.62	297	
Vera	G. Friesland	3 years	5644 40	228.51	4.05	300	
Very Nice III.... ...	G. Friesland	Mature	7694.00	310.86	4 04	274	
Thipiri I.	G. Friesland	Mature	8711.60	381.87	4 38	275	
Spitfire	G. Friesland	Mature	9863.30	337.86	3.43	296	
Suund	G. Shorthorn... ...	Mature	8199 90	297.06	3.62	287	
White II....	G. Afrikander... ...	4 years	7807.50	414.64	5.31	300	
Chidakwa	G. Friesland	Mature	7585.30	273.13	3.60	278	
Mynhardt	G. Friesland	Mature	6958 30	258.96	3.72	275	
Compound	G. Friesland	Mature	9108 00	331.69	3.64	285	
Bubbles	G. Friesland	Mature	6757 80	252.61	3.74	271	
Kingstone	G. Friesland	Mature	7823.90	322.74	4.13	300	
Natarara...	G. Friesland	2 years	6023.90	227.62	3.78	300	
Linda	G. Friesland	2 years	5177.30	291.37	5.63	300	
Buller	G. Friesland	2 years	4647.90	230.45	4.96	286	
David	G. Friesland	Mature	7382.80	261.96	3.55	300	
No. 53	G. Friesland	Mature	8012.20	249.04	3.11	285	P. Freeland, Lingfield, P.O. Gwelo.
Maggie	G. Friesland	Mature	9142.60	310.40	3.39	300	
Crab	G. Friesland	Mature	9948.90	299.52	3.01	300	
Longone	G. Friesland	Mature	6593.70	240.81	3.65	293	
Foot	G. Friesland	Mature	7200.80	235.49	3.27	300	
No. 122	G. Friesland	Mature	5516.10	225.30	4.08	300	W. N. Gebbie, P.B. 19A, Salisbury.
Effie	G. Friesland	Mature	12334.00	398.44	3.23	300	Hon. H. V. Gibbs, Bonisa, P.B. 52L, Bulawayo.
Lizzie	G. Friesland	Mature	9279 00	314.50	3.39	300	
Olga	G. Friesland	Mature	8806 00	344.31	3.91	300	
Rene	G. Friesland	4 years	11978.00	420.73	3.51	300	
Watson	G. Friesland	4 years	6987.00	243.79	3.48	300	
Trudy	G. Friesland	3 years	6028 00	275.59	3.43	300	
Fun	G. Friesland	Mature	7174.00	254.06	3.54	300	
Merle	G. Friesland	Mature	10909.00	357.82	3 28	300	
Fairy	G. Friesland	Mature	8051.00	306 30	3 80	300	
Dolly	G. Friesland	Mature	9872.00	312 37	3 16	300	
Maggie	G. Friesland	Mature	9416.00	359.18	3 81	300	
Ethel	G. Friesland	Mature	8567.00	265.94	3.10	294	
Kath	G. Friesland	Mature	9548.00	332.22	3.48	300	

SEMI-OFFICIAL.—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Neruwazi	G. Friesland	Mature	5218.50	227.70	4.36	300	C. A. G. Gourlay, Box 244, Umtali.
No. 157...	G. Red Poll	Mature	9122.30	384.61	4.22	300	Government Experimental Station, P.B. 19K, Bulawayo.
No. 13	G. Friesland	Mature	11092.40	407.28	3.67	300	Grasslands Experimental Station, Marandellas.
No. 16	G. Friesland	Mature	11118.70	343.61	3.09	300	
No. 20	G. Friesland	Mature	11920.60	451.64	3.79	300	
No. 21	G. Friesland	Mature	7204.60	233.34	3.24	248	
No. 23	G. Friesland	Mature	12568.20	461.97	3.68	300	
No. 25	G. Friesland	Mature	10208.90	365.51	3.58	300	
No. 38	G. Friesland	4 years	11232.70	352.27	3.14	300	
No. 49	G. Friesland	3 years	9891.40	306.17	3.10	300	
No. 60	G. Friesland	2 years	7545.20	292.89	3.88	300	
No. 56	G. Friesland	2 years	8785.70	320.00	3.64	300	
No. 16	G. Friesland	Mature	6889.10	278.27	4.05	300	R. H. Greaves, Nyamandhlovu.
Corvill...	G. Friesland	Mature	7459.00	296.70	3.98	300	Gwebi Govt. Farm, P.B. 76B, Salisbury
Queenie II.	G. Guernsey	4 years	6700.70	272.49	4.07	300	D. A. Harley, Harleyton, Beatrice.
Milly	G. Guernsey	Mature	5890.90	228.01	3 87	279	
Pauline	G. Friesland	Mature	7227.40	264.30	3.66	300	
Vida	G. Guernsey	Mature	6611 40	281.46	4.26	300	
Flora	G. Guernsey	Mature	9194.40	324.64	3.53	300	
Alma	G. Guernsey	Mature	10995.30	454.53	4.13	300	
Elsie	G. Guernsey	Mature	6420.80	271.70	4.23	300	
Cherry	G. Guernsey	Mature	7843.50	341.63	4.36	300	
Julia	G. Guernsey	Mature	6143.70	267.62	4.36	300	
Hillary	G. Guernsey	Mature	8146.80	284 69	3.49	300	
Jean	G. Guernsey	Mature	6872.20	298.01	4.34	300	
Lily...	G. Guernsey	Mature	6429.70	270.59	4.21	300	
Gloria	G. Guernsey	Mature	5916.80	228.11	3.86	283	
Janet	G. Guernsey	Mature	6394.30	253.05	3.96	300	
Dixie	G. Friesland	Mature	9731.90	321.94	3.31	300	Mrs. C. Harrison, Box 58, Shamva.
Belinda	G. Friesland	Mature	5223.00	227.79	4.36	300	N. M. Hathaway, Chakadenga, Mangwendi.

Blanche	G. Friesland	3 years	7904 80	272.80	3.45	300	D. J. Huddy, Box 718, Salisbury.
Frances	G. Friesland	3 years	7099.20	233.91	3.29	300	
Kufara	G. Friesland	4 years	6828.60	249.99	3.68	300	
Lucky	G. Friesland	2 years	7835.20	285.34	3.64	300	
Nancy	G. Friesland	4 years	7520.80	241.79	3.21	300	
Olga	G. Friesland	3 years	10365.60	354.39	3.42	300	
Patsy	G. Friesland	3 years	6714.00	227.39	3.39	255	
Petal	G. Friesland	Mature	6916.90	279.20	4.04	297	
Rosemary...	G. Friesland	3 years	6957.50	265.41	3.81	300	
Stembok	G. Friesland	Mature	8377.30	281.24	3.36	285	
Waasie.., ...	G. Friesland	Mature	7893.40	263.94	3.34	300	
Witkwas	G. Friesland	Mature	8174.20	298.70	3.65	300	
No. 2	G. Friesland	Mature	6589.10	247.53	3.76	300	
Joyce	G. Friesland	Mature	6658.50	251.12	3.77	300	L. Huddy, Amalinda, Box 924, Salisbury.
Nancy	G. Guernsey	Mature	5694 70	242.23	4.27	300	
Stingo	G. Friesland	Mature	7653.10	297.36	3.89	300	
Manwere	G. Friesland	Mature	7649.30	251.03	3.28	300	
Bymby...	G. Friesland	Mature	7301.00	259.84	3.56	300	
Pixie	G. Guernsey	Mature	7080.90	258.83	3 66	300	
Grace	G. Friesland	Mature	7910.00	272.86	3.45	300	
Juma	G. Cross Shorthorn	Mature	6560.00	234.16	3.57	300	Mrs. M. R. Huddy, Hopley Farm, Salisbury.
Beatrice	G. Guernsey	Mature	6262.50	236.12	3.77	300	
Question	G. Friesland	Mature	5617.50	240.75	4.28	300	I. Jaffe, Mazani, Umtali.
J.J. 71	G. Friesland	Mature	17648.00	764.59	4.34	300	J. Jamieson, Box 217, Bulawayo.
J. 60/1	G. Friesland	2 years	9014 00	344.51	3.82	300	
J. 11/2	G. Friesland	Mature	7754.00	283.61	3.66	300	
J. 176	G. Friesland	Mature	13340.00	461.14	3.46	300	
J. 6/1	G. Friesland	2 years	7620 00	287.32	3.77	300	
J. 94/1	G. Friesland	Mature	9314 00	327.90	3.52	300	
J. 49/1/1	G. Friesland	2 years	8001.00	254.76	3.18	300	
J. 103	G. Friesland	Mature	11523.00	356.82	3.10	300	
JJ 49/2...	G. Friesland	3 years	16764.00	546.38	3.26	300	
J. 29/1	G. Friesland	Mature	15104.00	478.52	3.17	300	
JJ 200	G. Friesland	Mature	12675.00	463.64	3.66	300	
JJ 71/1	G. Friesland	4 years	13652.00	539 05	3.95	300	
JJ 56	G. Friesland	Mature	9418.00	321 70	3.42	300	
JJ 175/1	G. Friesland	Mature	12846.00	428.12	3.33	300	

SEMI-OFFICIAL—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner
No. 60	G. Friesland	Mature	9918.00	381.50	3.85	300	D. S. Kabot, Box 261, Bulawayo.
No. 16	G. Friesland	Mature	9563.00	339.92	3.56	300	
No. 59	G. Friesland	Mature	7699.00	287.81	3.74	275	
K 18	G. Friesland	4 years	8233.00	318.61	3.87	300	B. H. Kew, Box 972, Bulawayo.
No. 18	G. Friesland	Mature	7350.70	243.93	3.32	300	
D 15	G. Friesland	Mature	7275.60	307.64	4.23	267	
Pat	G. Red Poll	Mature	7183.80	265.99	3.70	300	H. Knill, Mendamu, Marandellas.
Mary	G. Friesland	Mature	9817.20	317.89	3.24	300	Mrs. M. Krahner, Haydock Park, Banket.
Magwagwa I.	G. Friesland	Mature	7102.50	253.40	3.57	300	P. Linton, Box 898, Salisbury.
Mtawa I.	G. Friesland	Mature	7798.00	295.74	3.80	300	
Mapie II.	G. Friesland	Mature	7384.60	276.21	3.74	300	
Mompara IV.	G. Friesland	4 years	7264.00	251.01	3.46	300	
Sedina	G. Friesland	Mature	6271.50	235 74	3.76	300	
December I.	G. Friesland	Mature	6204.20	242.77	3.91	300	
Mahuli II.	G. Friesland	Mature	7174.00	270.03	3.76	300	
Jeempee IV.	G. Friesland	Mature	7370.10	277.05	3.76	300	
Marandellas IV.	G. Friesland	Mature	6720.00	229.95	3.42	300	
No. 17	G. Friesland	Mature	8374.60	258.12	3.08	300	D. W. Marshall, Box 164, Umtali.
No. 10	G. Friesland	Mature	7997.70	284.09	3.55	300	
No. 356	G. Guernsey	Mature	8253.00	357.12	4.33	290	J. R. McLaren, Safago, Gwelo.
No. 406	G. Guernsey	4 years	6034.10	257.07	4.26	300	
No. 425	G. Guernsey	3 years	6193.90	293.34	4.73	300	
No. 424	G. Guernsey	3 years	6100.80	288.95	4.74	300	
No. 455	G. Guernsey	2 years	5691.00	314.66	5.53	300	
No. 334	Common	Mature	6419.60	259.39	4.04	263	
No. 369	G. Guern./Fries.	Mature	5786.10	286.58	4.95	235	
Verano	G. Friesland	Mature	5946.30	260.30	4.38	300	J. H. McLean, Box 161, Gwelo.
Spuds	G. Friesland	Mature	4829.80	240.98	4.96	296	
Mealies	G. Friesland	3 years	5754.20	229.77	3.99	300	
Babs	G. Ayrshire	4 years	4844.40	254.10	5.24	300	
Dawn	G. Friesland	Mature	7152.40	263.49	3.68	300	
Jessie	G. Friesland	Mature	6662.70	298.29	4.48	300	

G 32/7	G. Friesland	Mature	12075.00	375.69	3.11	300	Meikles Trust, Leachdale Farm, Shangani.
P 12/1	P.B. Friesland ...	4 years	8726.00	275.51	3.16	300	
G. 13/7	G. Friesland	Mature	11864.00	387.24	3.26	300	
P 15/2	P.B. Friesland ...	3 years	7993.00	263.62	3.30	300	
G 17/2	G. Friesland	3 years	6501.00	260.67	4.01	300	
G 4/0	G. Friesland	Mature	6274.00	234.09	3.73	300	
Elandskuil Resida XV. C/B Be 7/145	Ped. Friesland ...	Mature	8145.00	268.66	3.30	300	
P 377	P.B. Friesland ...	Mature	8835.00	334.01	3.78	300	
P 17/0	P.B. Friesland ...	Mature	9592.00	348.51	3.63	300	
P 5/9	P.B. Friesland ...	Mature	6684.00	235.29	3.52	300	
No. 16/9	G. Friesland	Mature	9344.00	314.00	3.36	300	
No. G 193	G. Friesland	Mature	11682.00	383.22	3.28	300	
P 1/9	P.B. Friesland ...	Mature	10700.00	353.22	3.30	300	
P 9/8	P.B. Friesland ...	Mature	11262.00	391.86	3.48	300	
G 22/9	G. Friesland	Mature	7588.00	265.92	3.50	300	
G 18/0	G. Friesland	Mature	8162.00	249.84	3.06	293	
G 1/9	G. Friesland	Mature	8444.00	302.02	3.58	300	
G 6/8	G. Friesland	Mature	10834.00	375.11	3.46	300	
G 25/0	G. Friesland	Mature	15018.00	500.80	3.33	300	
No. 8/8	Ped. Friesland ...	Mature	10050.00	345.25	3.43	300	
Sunrise I....	G. Friesland	Mature	10303.50	345.29	3.35	300	W. S. Mitchell, Springs Farm, Iron Mine Hill.
Mitchlin Dignity C II.	Ped. Friesland ...	Mature	11327.00	341.56	3.01	300	
Mitchlin Daphine	Ped. Friesland ...	3 years	8470.50	256.62	3.03	300	
Mitchlin Dignity D II.	Ped. Friesland ...	2 years	6816.50	216.27	3.17	300	
Mitchlin Beauty's Astoria	Ped. Friesland ...	3 years	5788.00	217.36	3.75	300	
Mitchlin Lily's Beauty	Ped. Friesland ...	Mature	8561.00	268.83	3.14	300	
Norah	P.B. Friesland ...	Mature	5670.60	225.30	3.97	300	Mitchell & Harvey, Argyll, Odzi.
Mrs. Simpson	G. Lin. Red/ Shorthorn	Mature	6475.30	289.15	4.47	300	G. R. Morris, Box 1040, Salisbury.

SEMI-OFFICIAL—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Norah	G. Ayrshire	Mature	7643.20	274.26	3.59	272	Commander E. L. Morant, Box 741, Salisbury.
Pamela	G. Ayrshire	Mature	6846.80	241.37	3.53	300	
Onyx	G. Ayrshire	Mature	6186.20	228.99	3.70	300	
Dahlia	G. Shorthorn	Mature	4252.70	229.12	5.39	300	
Soap	G. Friesland	Mature	8373.90	263.71	3.15	300	S. Moore, Box 999, Salisbury.
Pamela	G. Friesland	Mature	4591.70	234.68	5 11	300	
Snowdrop	G. Friesland	Mature	5393.30	231.28	4.29	300	
G.I.	G. Guernsey	4 years	5818.40	234.93	4.04	300	
Jane II.	G. Friesland	Mature	7591.00	245.42	3.11	300	F. B. Morrisby, Sunnyside, Gwelo.
Fay	G. Friesland	Mature	8434.00	305.76	3.62	300	
No. 80	G. Friesland	Mature	9725.00	310.80	3.19	300	
No. 156	G. Friesland	Mature	8141.00	254.85	3 13	300	
No. 131	G. Friesland	Mature	7479 00	253 42	3.39	300	
No. 144	G. Friesland	Mature	9408.00	335.82	3.57	300	
No. 152	G. Friesland	Mature	8318.00	323.87	3.89	300	
No. 154	G. Friesland	4 years	8314.00	292.96	3.52	300	
No. 137	G. Friesland	Mature	7510.00	261.18	3.48	300	
No. 86	G. Friesland	Mature	9003.00	309.79	3.44	300	
Longone	G. Friesland	Mature	6974.10	279.74	4.01	300	J. T. Mungle, Myreside, Odzi.
Imbuya	G. Friesland	Mature	5711.80	239.54	4.19	300	
Zimunga	G. Friesland	Mature	7588 20	272.79	3.60	300	
Jenny	G. Friesland	Mature	5905.10	268.56	4.55	300	
Manyerket	G. Friesland	Mature	8682.10	315.29	3.63	300	
Banana	G. Friesland	Mature	6122.00	227.24	3.71	236	Kenneth Norvall, Box 637, Bulawayo.
Queenie	G. Friesland	3 years	7341.00	255.22	3.48	300	
Girlie	G. Friesland	Mature	9717.00	332.86	3.43	300	
Clynie	G. Friesland	Mature	7103 00	269.44	3.79	272	
Victoria	G. Friesland	3 years	7137.00	253.83	3.56	300	
Thirteen I.	G. Friesland	4 years	7358.00	253.30	3.44	300	
Joan	G. Friesland	3 years	7046.00	260.14	3.69	300	

Daisyfield...	G. Friesland	Mature	7680.00	289.65	3.77	300	
Johanna of Cartrep	P.B. Friesland ...	Mature	7397.00	235.11	3.18	300	
Greece...	G. Red Poll	Mature	7654.00	257.72	3.37	300	
Agnes	G. Red Poll	Mature	5712.00	233.44	4.09	300	
Spoof	G. Friesland	4 years	7533.00	230.88	3.07	300	
Zenda	G. Friesland	Mature	7587.00	280.26	3.69	276	
Tina I.	G. Friesland	3 years	8089.00	288.09	3.56	300	
Olifant...	G. Friesland	Mature	8324.00	282.89	3.40	300	
Helen	P.B. Friesland ...	4 years	6922.30	265.23	3.83	287	E. Palmer, Ferndale, Penhalonga.
Topsy	G. Friesland	Mature	7743.80	260.25	3.36	270	
Edna	G. Friesland	Mature	9428.30	294.01	3.12	265	
No. 93	G. Friesland	Mature	6763.00	242.34	3.58	300	T. C. Pascoe, Crowborough Estate, Box 1253, Salisbury.
No. 54A...	G. Friesland	4 years	7313.90	256.94	3.51	300	
No. 121...	G. Friesland	Mature	6916.80	227.13	3.28	278	
No. 190...	G. Friesland	Mature	7161.90	241.41	3.37	300	
No. 189...	G. Friesland	Mature	6797.50	227.06	3.34	300	
No. 128...	G. Friesland	Mature	8670.00	306.72	3.54	300	
No. 198...	G. Friesland	4 years	7089.20	303.74	4.28	289	
No. 58	G. Friesland	Mature	6914.90	249.65	3.61	300	
No. 152...	G. Friesland	Mature	6523.30	287.10	4.40	300	
No. 59	G. Friesland	Mature	7664.00	277.23	3.62	294	J. Picken, Iron Mine Hill, P.O. Iron Mine Hill.
Zola...	G. Friesland	Mature	6369.50	239.05	3.75	300	Mrs. S. B. Worthington Reed, Box 19, Gwelo.
Amelia...	G. Friesland	Mature	9542.00	330.17	3.47	300	Rhodesian Corporation, Ltd., Kent Estate, Norton.
Margaret	G. Friesland	Mature	6801.00	230.94	3.40	300	
Cheepy...	G. Friesland	Mature	7431.50	251.34	3.38	300	Mrs. M. Rogers, Bickford, Gwelo.
Rice	G. Friesland	Mature	7215.50	248.53	3.44	270	
Lam	G. Friesland	4 years	6907.00	247.84	3.59	300	
Bucket	G. Friesland	Mature	7486 50	234.40	3.13	300	
Townde...	G. Friesland	4 years	7471.50	234.29	3.14	300	W. F. H. Scutt, Maple Leaf, Norton.
Luka	G. Friesland	3 years	6828.00	248.91	3.65	300	
Aron...	G. Friesland	Mature	9855.30	355.65	3.61	300	
Paolo	G. Friesland	Mature	8698.30	282.64	3.25	300	
Milika	G. Friesland	Mature	7865.50	278.55	3.54	300	
Wilson	G. Friesland	Mature	6792.40	260.29	3.82	300	
Nutele	G. Friesland	Mature	8710.80	298.36	3.43	300	

SEMI-OFFICIAL—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Machara I.	G. Friesland	Mature	6061.00	252.61	4.17	300	E. Stanger, Chimbi Source, Rusape.
Tina...	G. Friesland	4 years	7396.00	259.74	3.51	300	Susman & Newfield, Box 959, Salisbury.
Beans	G. Friesland	Mature	8520.00	329.85	3.87	255	Evelyn Tapson Trust, Ltd., Lesapi Falls, Rusapi.
Blanket III....	G. Ayrshire	Mature	8104 00	248.03	3.06	300	
Bromley	G. Friesland	Mature	5897.00	234.14	3.97	229	
Bulawayo	G. Friesland	Mature	9627.00	313.03	3.25	300	
Djonifa I....	G. Friesland	Mature	6677.00	269.59	4.04	300	
Frawm...	G. Red Poll	Mature	7413.00	238.58	3.22	300	
Goley	G. Friesland	Mature	7781.00	257.38	3.31	300	
Hinduska	G. Friesland	Mature	6907.00	286.77	4.15	300	
Mabuds...	G. Friesland	Mature	9303.00	298.97	3.21	300	
Rosa...	G. Friesland	Mature	7260.00	227.61	3.14	300	
Rusape I.	G. Ayrshire	Mature	5624.00	239.16	4.25	300	
Betty	G. Friesland	Mature	6947.80	247.68	3.56	300	A. W. Tennent, Kelvin, Headlands.
Night	G. Friesland	Mature	5600.40	232.62	4.15	300	
Polly	G. Friesland	Mature	6227.90	239.47	3.85	284	
Lass's Valerie of Rynheath	P.B. Guernsey ...	Mature	5392.00	238.82	4.43	300	A. F. H. Valentine, Battery Spruit, Umtali.

Southern Rhodesia Veterinary Report.

FEBRUARY, 1947.

Diseases. African Coast Fever. No extensions of the disease were reported in Chipinga or Melsetter districts. Eight deaths were recorded on the infected farms in Chipinga.

Anthrax. Four outbreaks were reported from Fort Victoria district, three in native areas and one in the European area.

Trypanosomiasis. Three cases were reported from Chipinga area.

Lumpy Skin Disease. Nine new centres of infection were recorded in Salisbury district and the disease remains very mild.

Piroplasmosis. An increase in this disease has been noted in all districts. An outbreak with a mortality of 130 head was reported from Bulawayo in a herd of 400 head, this is the largest mortality that has occurred in the country for many years.

Anaplasmosis. An increase in this disease is also reported, but the mortality has not been high.

Tuberculosis. Four carcases of pigs were condemned in Umtali Abattoirs. No cases were recorded in Bulawayo or Salisbury.

Mallein Test. Thirty horses were tested with negative results.

Tuberculin Test. Nineteen bulls, 30 cows, 8 heifers and 19 yearlings were tested with negative results.

IMPORTATIONS.

United Kingdom: 1 bull (breeding).

Union of South Africa: 15 bulls (breeding), 57 cows and calves, 12 horses and mares, 22 geldings, 310 sheep (slaughter), 62 sheep (breeding).

EXPORTATIONS.

Union of South Africa: 1 gelding.

Northern Rhodesia: 4 bulls, 1 pig (breeding), 964 sheep (slaughter).

Portuguese East Africa: 53 oxen (slaughter).

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage.

Union of South Africa: Meat rolls 7,134 lbs., ham 10,898 lbs., sausage 2,042 lbs., fats 1,944 lbs., pork 5,625 lbs.

Northern Rhodesia: Beef 53,741 lbs., bacon 1,216 lbs., ham 185 lbs., sausage 526 lbs., fats 133 lbs., brawn 30 lbs., offal 7,654 lbs., pork 2,488 lbs., sausage casings 30 lbs.

Bechuanaland Protectorate: Beef 8,294 lbs., bacon 251 lbs., ham 171 lbs., sausage 566 lbs., fats 694 lbs., brawn 91 lbs., offal 262 lbs., pork 11 lbs.

Belgian Congo: Beef 142,921 lbs., bacon 882 lbs., ham 2,205 lbs., offal 20,329 lbs., pork 3,513 lbs., veal 2,759 lbs., poultry 196 lbs., mutton 102 lbs.

Portuguese East Africa: Beef 22,340 lbs., ham 6,124 lbs.

P. D. HUSTON,
Chief Veterinary Surgeon.

MARCH, 1947.

General. During the month rains fell in all districts, and reports of improvement in grazing were received from all except Bulawayo and Fort Victoria; in these latter districts the position is still critical. In the rest of the territory cattle are reported to be in good condition.

Tick Life. The incidence of ticks has increased in all districts except Melsetter and Chipinga owing to the restricted dipping programme that can be carried out. In Melsetter and Chipinga, where the drought has not been seriously felt, dipping is still being carried out regularly.

Movement from Drought Stricken Areas. During the month 9,825 head of cattle were moved into the Salisbury Veterinary District and 7,235 distributed to farmers.

Deaths amongst these cattle have been reported from redwater, gallsickness and internal parasites, but, except for these, the general opinion is that they have improved in condition.

Diseases. African Coast Fever. No extensions of this disease were reported and no deaths from it have taken place on any of the infected farms. Unfortunately one case of a putrid calf was found on Kenilworth which, if no further cases of the disease occur, will prolong the quarantine period.

Anthrax. One centre of infection, Majiri, in Umtilikwe Reserve, Fort Victoria, was diagnosed and 9,658 animals were immunised. This centre adjoins others reported last month.

Trypanosomiasis. Two cases were diagnosed at Chisa's Kraal, Ndanga district, which is close to the Portuguese East Africa border. This is a new infection.

In Chipinga area six cases were reported from previously infected farms.

Lumpy Skin Disease. Six new centres of infection have occurred in Salisbury district in the vicinity of old infected areas The disease is reported as being extremely mild with only a small percentage of the contact cattle becoming infected on each farm.

Theileriosis. There has been an increase in this disease during the month, thirteen centres being diagnosed.

In two cases the mortality was large and this was due to the movement of cattle for drought relief purposes having to take place over known infected veld.

An outbreak on a farm in Umtali district the end of January was cleared up by five day dipping and hand-dressing; the last death being recorded on 3rd March.

Piroplasmosis. Piroplasmosis is reported as increasing in all districts due again to the restricted dipping, and in Salisbury to the large movements of drought relief cattle.

Anaplasmosis. The remarks with regard to Piroplasmosis apply equally to this disease.

Quarter Evil. Only two cases reported.

Mallein Test. Fifty-three horses were tested with negative results.

Tuberculin Test. Four bulls were tested with negative results.

IMPORTATIONS.

Union of South Africa: 4 bulls, 17 horses and mares, 44 geldings, 136 sheep (slaughter), 25 goats (breeding).

United States of America: 1 bull.

EXPORTATIONS.

Northern Rhodesia: 497 sheep (slaughter), 3 bulls (breeding), 12 donkeys, 2 geldings.

Portuguese East Africa: 22 oxen (slaughter), 15 cows (slaughter).

Belgian Congo: 73 donkeys.

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage.

Union of South Africa: Beef 411,396 lbs., offal 10,875 lbs., bacon 6,131 lbs., ham 30,036 lbs., fats 10,358 lbs., poultry 2,019 lbs., sausage 1,225 lbs.

Northern Rhodesia: Beef 244,059 lbs., pork 16,513 lbs., offal 15,744 lbs., ham 1,453 lbs., fats 1,894 lbs., sausage 1,180 lbs., brawn 104 lbs.

Belgian Congo: Beef 312,612 lbs., veal 6,735 lbs., pork 4,857 lbs., offal 21,086 lbs., bacon 658 lbs., ham 3,616 lbs., poultry 205 lbs., sausage 30 lbs.

Portuguese East Africa: Beef 29,077 lbs., offal 3,096 lbs.

Meat Products from Liebig's (Rhodesia) Ltd., West Nicholson.

Union of South Africa: Corned beef 121,500 lbs., Ideal Quick Lunch 745 lbs.

P. D. HUSTON,
Chief Veterinary Surgeon.

SOUTHERN RHODESIA

Locust Invasion, 1932-47.

Monthly Report No. 173: April, 1947.

Red Locust: *Nomadacris septemfasciata Serv.*

No reports of locusts in any stage of development within the Colony were received.

J. K. CHORLEY,
Chief Entomologist.

THE RHODESIA
Agricultural Journal

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Editorial

Notes and Comments

P. R. B. HINDE, Esq., M.B.E.

It gave us much pleasure to see the name of Mr. P. Hinde included in His Majesty the King's Birthday Honours List. It is an honour well earned and we congratulate him most heartily.

DESTRUCTION OF TOBACCO PLANTS.

Tobacco growers are reminded that Virginia tobacco plants must be destroyed by 1st August and Turkish tobacco plants must be destroyed by 1st September in each year.

TREATMENT OF TOBACCO SEED: CHEMISTRY BRANCH.

Tobacco farmers are hereby notified that the Chemistry Branch, owing to pressure of other duties and a shortage of staff, is unable to carry out the cleaning and treatment of tobacco seed this year. Farmers should therefore arrange for this work to be done by one of the local firms which undertake it.

IMPORTANCE OF TRACE ELEMENTS.

The following notes are extracted from a lecture given by Professor J. A. Scott Watson to the Conference of Scottish agricultural students at Edinburgh on the 31st January, 1947, and which is reported in "The Journal of the Ministry of Agriculture" of April, 1947.

One of the earliest generalisations from Rothamsted and elsewhere was that among the large number of elements found

in plant ash all but three, calcium, potassium and phosphorus seemed to be provided by most soils in ample quantity. In recent years, however, conditions sometimes amounting to crop failure have been found to be due to trace element deficiencies. For example, it was found that reclaimed moorish or peaty land which had been drained and limed was often followed by a complete failure of the first crop of oats. The cause was manganese deficiency due to sudden soil reactions. Again a heart-rot in Sweden known as "Raan" which resulted when lime was applied to control another troublesome disease known as Club Root was due to boron deficiency. Both conditions can be prevented and cured by minute applications of manganese sulphate or borax as the case may be (approx. 1 part of trace element to 1,000,000 parts of soil). Other legumes failed to establish themselves even when all the known nutrient elements had been provided. It was then found that a dressing of 4 oz. molybdenum salt per acre (i.e., approx. 1 part in 10,000,000 of soil) was sufficient to ensure the normal growth of the clover. The molybdenum is not needed by the clover plant direct but by the symbiotic nodule organism on which it depends for its nitrogen.

PAPAIN EXTRACTION.

The milky latex of the green pawpaw contains an enzyme or active substance called papain. It has been found that this latex has several uses including preshrinking of wool and clarification of certain beverages. A considerable amount of work on papain extraction has been done in Australia, Peradeniya, South Africa and Tanganyika. Pawpaws require rich loamy soils and good well distributed rainfall. Seeds required for establishing a pawpaw plantation should not be taken from fruits that have been tapped for papain. Pawpaws are best grown as a pure crop rather than mixed with catch crops. Fruits used for collecting latex are naturally disfigured, but the fruit is suitable for canning.

Tapping the Fruit. Tapping can commence before the fruits are a year old and at intervals of 10 days. In Australia full length incisions ⅛ inch deep are made on the surface of green fruits with a stainless steel knife. The latex immediately flows out and is collected in a glass vessel. At first the latex exudes freely for about 8-10 seconds. Later the latex congeals on the surface, where it can be scraped off and collected. This is very tedious work, and as the fruits are apt to be crowded together it is not always possible to get full length cuts so the collection of latex can be a very slow process. The fruit is tapped in the wet summer months January, February and March, and the latex flow is generally highest in the early morning. It was found that pawpaw varieties with medium sized fruits which hang free are best from

the collecting point of view. The latex was obtained from immature fruits and from the pressed juices of leaves, leaf stalks and growing tips.

In South Africa there is a definite period for tapping, namely, from February to August. A steel bladed knife is used which makes a clean light incision without getting any of the green chlorophyll in the exuding juice. The latex is harvested through three years, and by the fourth year the fruit is so high on the trunk that the cost of collecting the juice is prohibitive.

The latex should be collected in non-metallic containers such as glass or porcelain dishes so as not to discolour the juice, and the latex should not come in contact with the hand. The addition of 1 per cent. formaldehyde prevents putrifaction, but has been found to reduce enzyme activity.

Yields. In Australia it was found that an average half-grown fruit of 2 lb. weight yields 2 cc. fresh latex, and although no accurate information of yields is available, it is said to be about 1 lb. dried latex per tree per year.

In Peradeniya experiments showed that correlation between the number of fruits and yield per tree was consistently positive while correlation between the number of fruits and yields per tree was consistently negative, while correlation between yield per fruit and yield per tree was inconsistent. Trees tapped every fourth day throughout the year gave a crop of 11½ oz. per tree per year. With trees planted at 10 feet x 10 feet this represents a yield of 312 lb. dried latext per acre per annum. These are average figures and may be exceeded by those from selected trees.

In South Africa the information on yields is scanty. Yields vary from 20 to 250 gms. per tree, or from 60 to 350 lb. of dried latex powder per morgen (2.12 acres). Coagulated latex produces 25 per cent. of its weight of dried powder.

In Tanganyika the yield of the dried product is from 60 to 100 lbs. per acre per annum.

Drying Process. In Australia some of the fresh latex was treated with alcohol or acetone while the latex samples were air dried on glass before despatching for tests on their enzyme activity. It was found that the juice pressed from the skin of the fruit had a higher rennase activity than that of the juice expressed from the fruit flesh.

In Tanganyika the extraneous matter is removed at the factory and the coagulated mass pressed through copper or brass gauze of 45-50 mesh to remove the last of the extraneous matter.

The coagulated mass is spread on white cloths on trays and placed in a drying kiln.* The dried product should be creamy white, crumbly and free from extraneous matter. Sundrying produces a darker product than kiln drying. After it is dried the papain is packed in empty 4-gallon petrol tins and the tins exported in petrol cases. The air should be extracted before sealing the tins.

In South Africa the latex is dried in a properly ventilated oven at 50 to 55° C. Great heat destroys the ferment.

*Various types of kilns are used and the time of drying is from 12 to 14 hours.

Literature—"Pawpaw Latex Production in Queensland." Pamphlet 108, Department Agricultuture and Stock, Queensland.

"East African Agricultural Journal," January, 1944.

"Tropical Agriculturist," Vol. I., 1946.

"Farming in South Africa," August, 1939.

RETIREMENT OF E. R. JACKLIN, Esq.

The Minister of Agriculture, the Hon. P. B. Fletcher, on behalf of the staff of the Department of Agriculture, made a presentation to Mr. Jacklin to mark his retirement from the Department. Mr. Jacklin joined the S.R. Government Service in 1931 and has been associated with various agricultural organisations. In addition to being Chairman of the Maize Control Board, Dairy Industry Board and Pig Industry Board, he was Director of Marketing. Mr. Jacklin was also an official member of the Cotton Research and Industry Board.

We wish him every happiness in his retirement.

ERRATUM.

P. 158 May/June R.A.J., 8th line "or 50 adult" should read "or 135 adult."

Washing of Fertiliser Bags.

Since the preservation of jute bags is a matter of considerable importance to farmers in this Colony we are reproducing herewith some notes which recently appeared in the "Agricultural Journal" of South Australia on washing fertiliser bags.

The Grain Bag Shortage Committee points out that although these notes refer only to superphosphate bags, nearly all commercial fertilisers with the exception of raw rock phosphate, have a destructive effect on such bags. It is recommended therefore that unless a consignment of fertiliser is to be used shortly after its receipt, the bags should be emptied on to a cement or other clean floor and washed immediately. It is very important that the bags should be dried thoroughly after washing before being stored, since moisture alone will cause rapid deterioration of the fabric.

Extract from the "Agricultural Journal" of South Australia dated February, 1947.

WASHING SUPERPHOSPHATE BAGS.

If superphosphate bags are properly washed the jute retains its strength and the bag can be used again with consequent saving of material and money. In some cases bags have been returned to fertiliser manufacturers for refilling as many as three or four times. . . .

Provided that sufficient water is available, no special treatment is required and the bags are simply allowed to soak in the water for about a fortnight.

A dam or a sheep dip is suitable for the purpose. However, if only a limited amount of water is available, it is advisable to neutralise the acidity of the bags by adding a small amount of washing soda. About a teaspoonful to the gallon of water is sufficient.

Under such circumstances the bags have a longer life if they are rinsed in clean water after having soaked in the soda solution.

The water in dams will not be affected for consumption by stock by the washing of superphosphate bags, whilst on many farms and in most districts sheep dips are available that can be utilised.

In view of the shortage of jute goods and the fact that with the improvement in superphosphate quality the bags will be in a better condition than during the war period, the preservation of the superphosphate bag by washing shortly after emptying is recommended.

It is, of course, necessary to thoroughly dry the bags by hanging in the open before storing.

Tung Nut Growing.

By C. N. HAYTER, F.Inst. P.A. (S.A.), Government Horticulturist.

In view of the numerous enquiries that are being received regarding tung nuts, some information about their cultivation and prospects may be of interest.

At the moment, approximately 237 acres of tung trees are being grown in Southern Rhodesia. Two years ago the acreage was 600, and this drop can be explained as follows:—

Early in 1930 a trial consignment of tung seed of *Aleurites fordii* was distributed to certain farmers to test its growth and suitability to Southern Rhodesian conditions.

Generally speaking, the results were, on the whole, disappointing, the growth being too slow to make it a very profitable crop. Most growers grubbed out their trees after a few years, but a few others tended them and obtained fair returns.

Subsequently, supplies of the *Aleurites montana* species of seed became available, and the tree growth and cropping capacity increased rapidly, strikingly illustrating its suitability to the climate, as has been proved by the numerous plantings in Nyasaland and the warmer parts of South Africa, where large acreages exist.

At the Government Sub-Tropical Experimental Station, Umtali, approximately 20 acres of tung trees of boh Fordii and Montana are growing, which were planted from 1938 onwards. In every instance, where the trees are grown alongside each other, the Montana species has outgrown Fordii three or four times with the same increase in crop.

The trees commence bearing in the third year, producing 3-10 lbs. of nuts each, and the yield continues to increase from year to year, with trees at 10 years old yielding from about 1,000 to 1,500 lbs. of nuts per acre, the trees being planted at 15 x 30 ft. apart to begin with and later thinning to 30 ft. square before being overcrowded. Budded trees naturally give the highest yields.

The pre-war price of nuts was from £25 to £30 a ton at the factory (Johannesburg), and varied during the past two years from £50 to £60 per ton according to oil content. These prices have since been reduced somewhat, the exact figure being awaited.

It will thus be seen that it is not a high-priced crop, but it must be realised that once the trees are planted, little attention is necessary and the trees can eventually be grazed beneath.

Tung trees are not particular about kind of soil, provided it is of good depth. A rainfall of 30 inches upwards suits them best.

The first few years, crops such as ground nuts, beans, etc., may be grown between the trees.

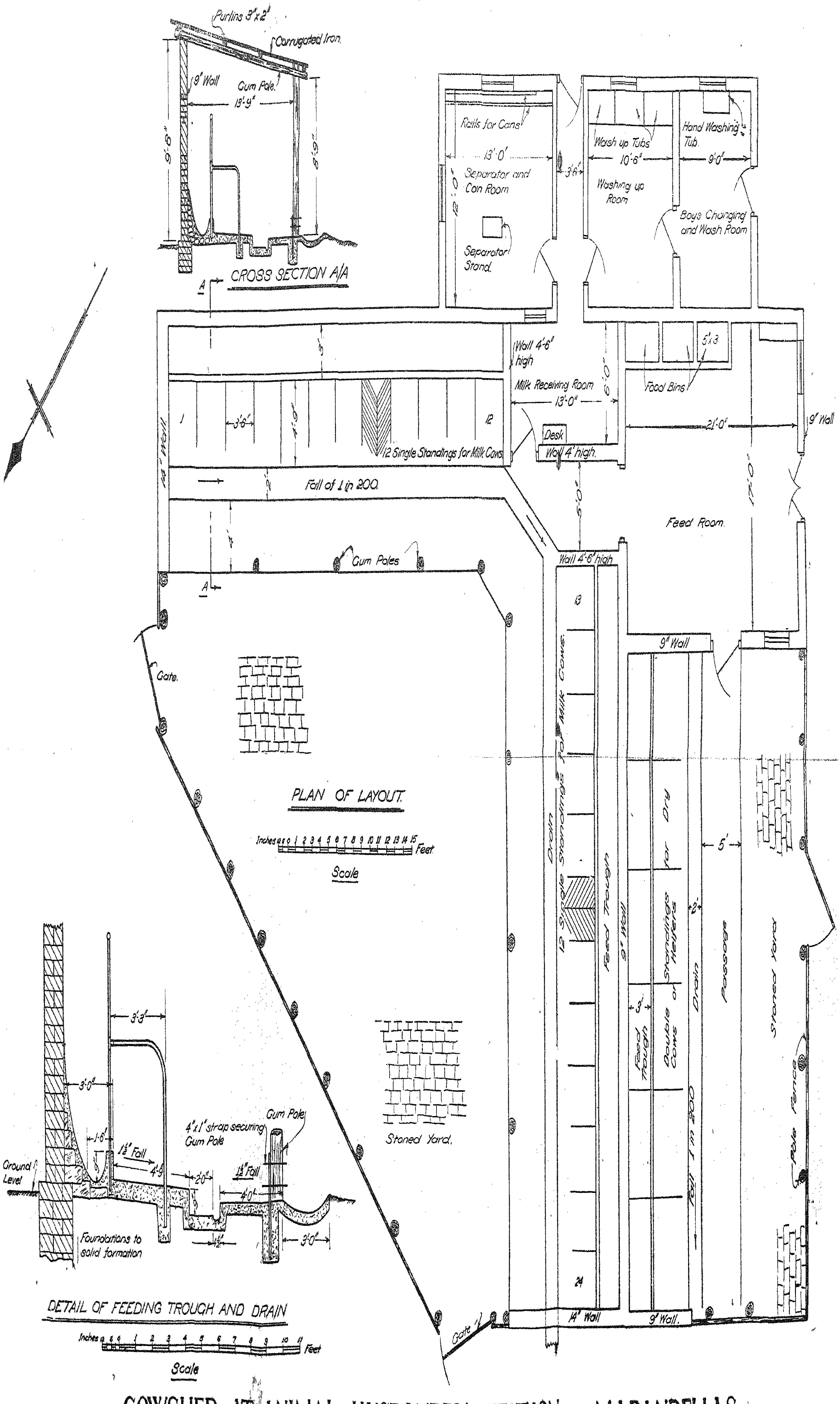
As the germination of the seed decreases rapidly, it should be sown soon after it is ripe. Such seed is now available from the Department of Agriculture at 2/- a lb., or £7 10s. per 100 lbs. A free issue of one pound of nuts (approximately 120 seeds) is available to each Southern Rhodesian applicant requiring such for trial.

They should be sown immediately, 1½-2 inches deep, in seed-beds in rows at 6 inches by 1 foot apart. Such seed germinates in six to eight weeks.

Planting out of the trees into permanent positions with the rains in late January is advisable.

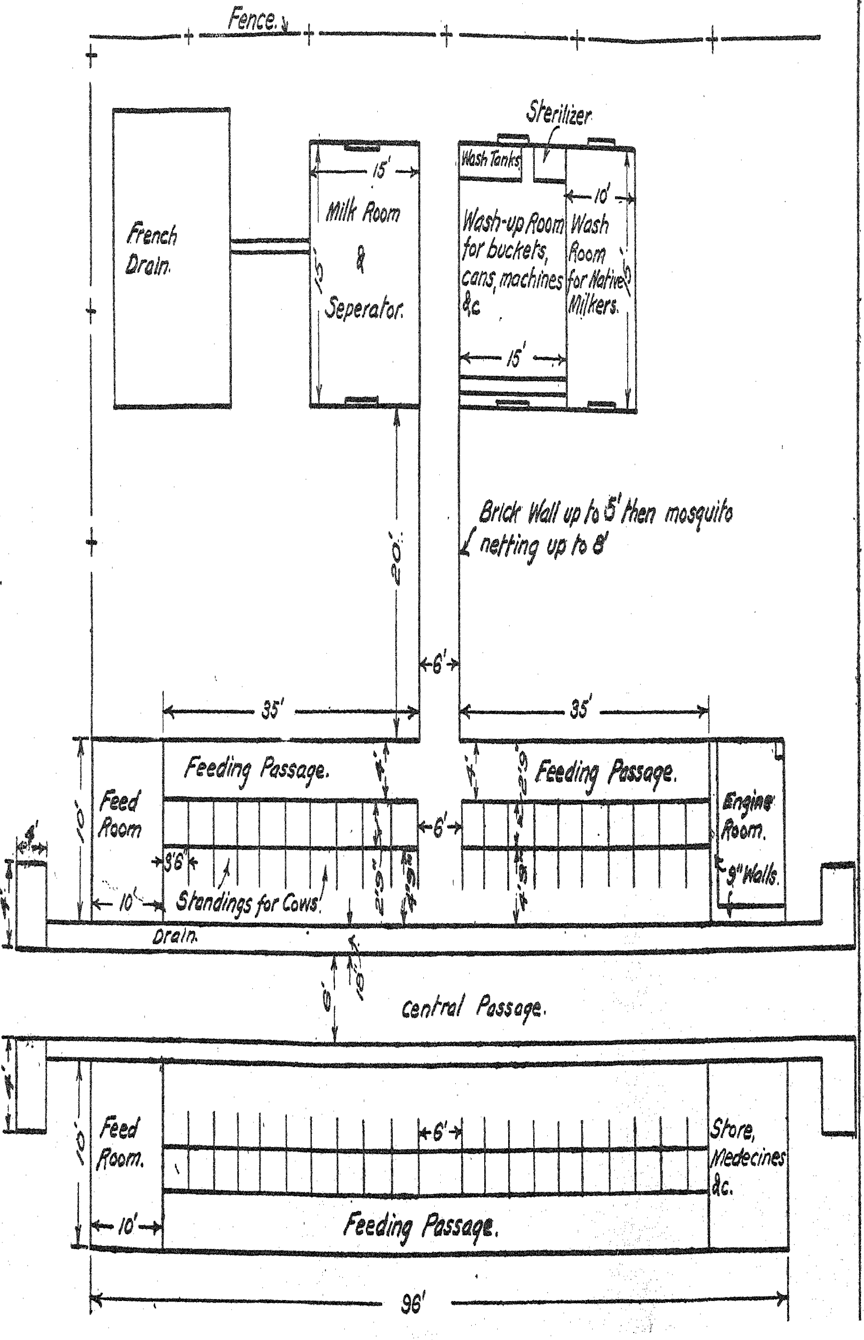
At present no mills for expressing the oil exist in the Colony owing to the small acreage, and nuts have to be sent either to the Union or Nyasaland.

It is hoped that time will permit the writing of a more detailed article on tung nut cultivation in the near future.



COWSHED AT ANIMAL HUSBANDRY STATION MARANDELLAS.

GROUND PLAN - MILKING SHED - DAIRY TYPE "B"



The Milking Shed.

By the Dairy Branch.

There are many designs for milking sheds, all having points of merit, and each different design adapted to suit some purpose that the farmer has in mind.

The success of the modern stable is to be found in simplicity, the correct floor construction, and ample ventilation.

It was customary some years ago to construct the milking shed or cow stable as though it were a dwelling house: windows were provided, which were carefully closed at night, and the cows comfortably bedded down on hay.

To-day it is realised that cows do not require all this comfort; moreover, they are healthier without it. Consequently, the stable is used merely as a milking place, the only items of real importance being the floor, constructed so as to make it easy to clean, and the provision of ample ventilation, and the complete absence of hay and bedding on the floor, which is really only a source of milk contamination.

It is not possible to describe all the different types of sheds in use. Either one of the two designs which are illustrated in this bulletin should suit most farmers, or enable them, with a possible alteration here or there, to design a shed to meet their individual requirements or fancies.

In the construction of the cow stable, and when considering either of the two drawings, careful consideration must be given to the floor, correct layout of which is so essential for easy cleaning, and the comfort of the cows.

The manger, for instance, should be not less than 3 feet wide. Eighteen inches to 2 feet is sufficiently wide enough for the average cow to consume her concentrate ration, which is the only feeding stuff that should be fed in the stable, but these lesser measurements do not make for cow comfort. It will be found that where cows are restricted in manger area, they are prone to step back with their hind legs in the manure channel. The object of the manure channel is thus defeated.

The standing space:—This, it will be noted, is given as 4′ 9″ (4 feet 9 inches), that is the space occupied from the edge of the manger to the edge of the manure channel.

This distance has been proved to be ample for the average sized cow, and it is quite unnecessary to exceed this measurement. No stable is complete without a suitable and solidly constructed manure channel. This essential feature is the secret of a convenient and easily cleaned stable.

Special note should be taken of the depth of the drain, which is 9″ (9 inches), immediately behind the cow's heels.

The underlying idea of this depth is that the cow is prone to step back to avoid facing a blank wall. When she steps back, her hind legs are considerably lower than the fore legs; this position is uncomfortable, and she is forced back on to the standing space provided.

The general layout of the stable at the Government Station, Marandellas, has proved to be a very popular design amongst dairymen: it is a very convenient plan without being elaborate. It embodies all the buildings necessary to the dairy farmer under one roof, all conveniently situated in relation to the cows.

Type B stable is a little more elaborate without being expensive, and is probably more convenient for the dairyman milking a large number of animals.

A feature of both these layouts is that provision is made for a wash- and changing-room for the milkers.

It is the aim and ambition of every dairyman to produce a clean and wholesome milk supply. This being the case, it follows that ways and means should be provided so that the milker can without difficulty have a wash or bath.

Single standings, that is, partitions at 3′ 6″ (3 ft. 6 in.) intervals, sufficient only to accommodate one cow in each stall, is recommended, and for obvious reasons. This partition is amply big enough for one single cow, but will not permit her standing sideways and fouling the standing space of the adjoining stall.

An important feature of both these designs is the provision of stanchions for tying the cows. These may be constructed of either metal or wood, but their inclusion is essential in order to restrict the cow's movements to the standing space provided.

Modern Milking.

(By the Dairy Branch.)

Recent research has brought to light several new and interesting facts concerning the mechanism of milk production. One of the leading investigators in this field is Professor W. E. Petersen, of Minnesoto University, whose theories on lactation and milk secretion are now almost universally accepted. Some of his findings are of great practical importance, but in order to understand and apply these, it is necessary first of all to appreciate the following fundamental facts concerning the construction and operation of the normal udder, viz., firstly, the fact that the udder is made up of four separate and distinct quarters, and secondly, that "milk secretion" and the actual "letting-down" of the milk are two entirely distinct processes in milk production. Let us consider, first of all, the structure of the udder and how it works.

The lowest part of each quarter of the udder is, of course, the teat, which is simply a tube with an opening at the bottom surrounded by a muscular ring, which prevents the milk from leaking out; above this muscle is the teat sinus, which opens at the top into the udder cistern, or milk cistern. Leading off from the milk cistern are numerous milk ducts which divide up into a countless number of smaller and smaller ducts, each of which eventually terminates in a very small round space called an alveolus, and which is surrounded with a layer of milk-secreting cells. The function of these cells is to manufacture milk and to pass it, when manufactured, into the alveoli. This is the actual process of milk secretion and it continues until stopped by the back pressure of the milk collecting in the alveoli, and does not recommence until the milk has been removed and the pressure reduced. The point to bear in mind here is that when a cow walks into her stall in the milking place or shed, practically all the milk she is going to produce at that milking is already in her udder. This is an interesting fact, for it was a commonly accepted theory not so long ago that a cow made her milk, or a large proportion of it, whilst she was actually being milked.

The next step in the production of the milk is to get the milk out of the udder, and this "letting-down" of the milk, as it is called, is brought about by contraction of the muscles surrounding each alveolus forcing the milk down the duct into the milk cistern. This contraction of the alveoli is a reflex action which the cow

herself cannot control. What happens is that the nerve endings in the cow's teat, when stimulated by the washing or handling of the teats, etc., preparatory to milking, send a message to the pituitary gland in the base of the cow's brain which in turn despatches a hormone—oxytocin—via the blood stream to the udder. This hormone causes the muscles around the alveoli to contract, thus forcing down the milk. The hormone usually reaches the udder about 40 to 60 seconds after stimulation, and is usually dissipated in seven to ten minutes; when this happens, the muscles relax. As long as the muscles remain contracted, so long will the milk continue to be let down. The moment they relax, the letting-down process ceases, and any milk which has not been forced out remains inside the udder. The practical significance of this is that, with the average cow, the dairyman has a period of not more than ten minutes in which to get all the milk away from the udder once the cow has been stimulated to let down her milk. This stimulus is usually provided by handling and washing the udder, although some hyper-sensitive cows are stimulated to let their milk down merely by being brought into the milking place, or, if a milking machine is used, by starting up the engine or motor which operates the machine. Dairymen who use milking machines have, no doubt, noticed that some of their cows start to drip milk as soon as the machine is started.

Conversely, it has been found that any unusual circumstance or excitement, fear, the presence of strangers in the milking shed, etc., may have an effect quite opposite to the above, and retard the letting down of milk. Every practical dairyman is acquainted with this phenomenon.

Research work on the lines above indicated has led to the following important conclusions:—

1. It is essential to give the cow a good strong stimulus to let down her milk just before milking. For this purpose it is not only essential that the cow should have quiet, comfortable surroundings, but that her udder should be washed, or at least wiped, before milking with a cloth dipped in hot water.

2. Hot water will give a stronger stimulus to letting down the milk than cold water. The temperature of the water used for this purpose should be about 125 degrees F., which is about as hot as the average person's hands can bear.

3. The cow should be milked before the stimulus to let down the milk has waned. As previously explained, this means that the cow should be milked out within seven to ten minutes after her udder has been massaged or washed with hot water. *This is important*, for if she is not milked out within this time, a certain

amount of milk may be retained in her udder, with consequent reduction in yield and shortening of lactation. In fact, Professor Petersen demonstrated that it was possible, in the case of machine-milked cows, to reduce their production by 20 per cent. within two weeks simply by washing their udders 20 minutes before putting the machine on them! And yet how often do we see a whole shed full of cows being washed and prepared long before any milking commences? In some cases the first cow to be washed is not milked for 30 minutes or more after washing!

4. In the case of machine milking, it is recommended that the cow should be washed not more than one minute before the machine is put on, and that it should be taken off again as quickly as possible. Professor Petersen has found that cows, even high milkers, can be trained to let down all their milk in three and a half to four minutes, or even less. In fact, it is claimed that whole herds have been switched in a matter of a few days to rapid milking, with considerable saving in time and, in some cases, gain in yield.

As far as hand stripping is concerned, it has been found that, provided the cow is milked quickly whilst the letting down stimulus is strong, the machine can remove just about all the milk. If this is done, it will be found that the great majority of cows can be milked clean out and hand stripping avoided.

Turning the compost. This shows how the whole heap is moved forward a few feet.

Garden Compost.

By S. D. TIMSON, M.C., Agriculturist.

(This replaces Bulletin No. 1250, now out of print.)

Amateur gardeners in our towns are finding it increasingly difficult to obtain supplies of kraal manure with which to make compost, and enquiries continue to be received regarding methods of making it without employing manure. This article is written with a view to meeting that need and also the demand for a simplified method of composting suitable for the householder or small plot holder in and around the towns.

Materials for Composting. Collect all waste materials of vegetable origin, such as the leaves of all trees (including gums and *Cedrela toona*), weeds, and old and green veld grass; straw, maize trash, kitchen wastes. Sawdust, waste paper and rags in moderate quantities can also be included in the compost heap. Crops such as Napier fodder, sunn hemp, and munga can also be grown on any spare ground for providing large quantities of raw materials. Lawn clippings are particularly valuable. In autumn a large quantity of dead leaves of trees and other valuable vegetable rubbish of our streets continues to be burned each year. All of this material should go into either the Municipal or private compost heaps to enrich the soils of our gardens.

Making the Heaps. Build these wastes into a heap 3 yards wide by any convenient length and 3½ to 4 feet high. Keep the sides tidy, and the top of the heap level. The heap is built up like a sandwich in layers. First put down a layer of the waste materials 6 inches in depth. (The depth of all layers mentioned is the depth after the next layer has been added. A little experience soon shows what initial depth the layers should be.) Over the layer of wastes spread 2 inches of fresh kraal manure, when this is obtainable. This should always be used if possible, but the following substitutes may be used instead:—

1. Adco reagent—obtainable from the local fertiliser firms. This is a mixture of fertilisers and lime.
2. Lawn clippings.
3. Green weeds.
4. Green veld grasses.

5. Green sunn hemp, grown on spare ground and cut when 2 feet high. It will grow again and can normally be cut several times, if planted in November or early December.

All these materials (other than Adco) should be wilted for a day before placing on the heaps, otherwise they tend to seal the "pores" of the heap and thus prevent proper aeration. A single one of these materials may be used, but a mixture of several is always best. They should be spread over the wastes to a depth of 2 inches. The Adco reagent should be spread over the wastes at the rate of 5 lbs. *for every 4 yards running length of the heap.*

Addition of Soil and Lime or Wood Ashes. Next spread evenly over the layer for every 4 yards length of the heap, half a grain bagfull of top-soil. Antheap soil can be used with advantage. Finally sprihkle wood ashes or agricultural lime over the layer lightly so that the surface appears greyish. If the soil is sandy, double the amount of ashes or lime. Now put down another 6 inches of wastes and then add in succession as described above, the required quantities of manure or substitutes, soil, and wood ashes or agricultural lime; and repeat the process layer by layer until the heap is built up to a height of 3½ to 4 feet. Cover the top with ¼ inch of soil.

Water Supply, and Aeration by Turning the Heap. A sufficient supply of moisture and, during the early part of the rotting process an ample supply of air, is essential to enable the fungi, and later the bacteria, to rot down the mixture of materials in the heap.

If the compost is made in the summer, after building a heap it will be left to stand until 4 to 5 inches of rain have fallen, or until the rain penetrates 6 inches, when the heap should be forked over, and all the materials, and the wet and dry portions of the heap in particular, should be well mixed together. Work from one end or one side of the heap, and throw the materials a convenient distance forward (about 4 to 5 feet) and rebuild the heap to the same approximate dimensions as before. In turning, the materials should be shaken with the fork so that the new heap is left in a loose and airy condition so as to permit air to enter it. Never trample on the new heap when turning, or allow anyone else to do so.

If you have an ample water supply available you can also make compost in the winter, and in this case, each layer of the sandwich is sprinkled with water after the soil and ashes have water. Then, as soon as the heap is made, the first turn must be given immediately. At each turn after the first, the unrotted outside portion of the heap must be turned to the inside of the heap.

Air Vents. After turning, aeration channels or vents may with advantage be made in the heap by thrusting a crowbar, or stiff wooden pole, down vertically through the heap and moving it sideways, with a circular motion, so as to leave an open hole to assist air to enter. Space the vents along the heap in two rows, which should be about 3 feet from the sides of the heap. The vents should be spaced about 4 feet apart in each row. When the heap is turned for the third time, the vents can be omitted.

Second Turn. The second turn, which can be arranged to move the heap back to its original position, should be made after 10 to 14 days, or as soon as the high temperature (about 140 degrees F.), which should develop in the heap after the first turn, obviously falls. This can be simply tested by keeping an iron rod stuck down into the heap, and testing the heat of the rod by hand. When the temperature of the heap is at its maximum (around 140 degrees F.) it is not possible to grasp the iron rod firmly in the hand. A little experience with this rough thermometer will soon teach one when the next turn should be given.

Subsequent Turns. Subsequent turns should be given at about 3- to 4-week intervals, or as soon as the "thermometer" indicates that the heap is becoming too cool. Immediately after a heavy rain-storm, the heap may be quite cool, but within 12 hours the temperature should again rise to its former level.

At all turns subsequent to the first, the unrotted or less rotted materials on the outside of the heap should be carefully placed in the inside of the new heap. This is to ensure that all the materials become sterilised by the heat and by the processes of decay, so that diseases, pests and weed seeds are killed.

At the second turn the wastes should be covered with a greyish mould. This is the mycelium of the actively growing fungi which commence the rotting process. If it is not present, it is usually due to excessive wetness of the heap. Normally the fungus growth is no longer seen at the third and fourth turns, when the materials have turned dark brown or black in colour.

Usually 4 turns are sufficient, and after the fourth turn the materials should have broken down to a blackish, crumbly mass, like old rotted leaf mould, and should have the same odour. It is better to leave the heap to mature for one month before use, but ripe compost should not be left exposed to the rains for longer, and should be dug into the soil or stored under cover. In the winter it can be safely left in heaps until required, since only slight losses of plant foods will occur when no rain falls on it.

Watering Heaps in Winter. At each turn subsequent to the first one, it is necessary to add some water to the heaps to keep the materials in that condition of moistness which can best be described as being that of a "squeezed out sponge." In other words, the materials should be moist, without being very wet or sodden. Much less water requires to be added at the second and subsequent turns than is added in building the heap. If the heaps are much exposed to wind it will usually be advisable to lightly water the outside of the heaps once or twice a week, since the outer 4 or 5 inches tends to dry out rapidly. If the heaps can be screened from the wind, all the better.

Rate of Application. In an article on the growing of vegetables (reprinted as Departmental Bulletin No. 1201), Marshall states that "the amount of manure or fertiliser to apply to the average garden soil depends on many factors, but good results may be expected from dressings of 15 to 17 tons of compost per

acre." An even layer of ripe compost (still moist) over the surface of the soil of a depth of one quarter inch is approximately equal to a dressing of 15 to 17 tons of compost per acre. Other simple measures of compost, which are rather more accurate, are as follows:—

Two petrol tinsfull (or one petrol boxfull) per 10 square yards of surface are roughly equivalent to a dressing of 11 to 12 tons per acre.

Five and three-quarters grain sacks full of compost roughly equal one cubic yard, or half a ton.

Twelve heaped-up barrow loads of compost roughly equal one cubic yard, or half a ton.

These rough measures are based on the approximation that two cubic yards of moist, ripe compost weigh one ton. It is more practicable to reckon dressings of compost on a volume basis than a weight basis, since the volume of compost changes much less during drying than its weight per cubic yard. Furthermore, it is much easier for the gardener or farmer to measure the volume of the compost rather than its weight.

Method of Application. Wherever feasible, compost should always be dug into the soil, and not left exposed on the surface. The latter practice is extremely wasteful, since the direct action of sunlight can break down the organic matter, strong winds can carry it away, and, above all, the ubiquitous white ants can gather it with the greatest facility and remove it to dress *their* gardens, which are well below the level of the feeding roots of most crops or garden plants. But, probably the worst feature of the practice of leaving top-dressings of compost exposed on the surface of the ground is that it cannot then properly exercise its very important beneficial effect in improving the crumb structure of the soil, and in stimulating the growth and activities of the beneficial micro-organisms in the soil, such as the nitrogen fixing bacteria.

Giant Rhodes Grass Pastures at Trelawney.

By J. M. RATTRAY, M.Sc., Pasture Research Officer.

The establishment of more highly productive pastures than the natural veld has always aroused much interest among the farming community of Southern Rhodesia. An account, therefore, of the experiences of R. and I. Faed on the farm Ziroto, in the Trelawney district, with Giant Rhodes Grass pastures, may prove useful to many farmers where conditions of soil and climate are similar. The acreage planted to this grass on Ziroto is now 120 acres, and the owners plan to increase the area considerably in the next few years.

The farm Ziroto, on which these pastures were grown, is situated about eight miles from Trelawney on average granite sandveld with an annual rainfall of between 30 ins. and 35 ins. and an altitude of about 4,500 feet.

History of Pasture Land. The land first planted to Giant Rhodes Grass was stumped in 1935, and carried the following crops until it was put down to grass in 1943:—

1935-1936: Stumped and planted to Virginia Tobacco.
1936-1937: Maize.
1937-1938: Ground nuts.
1938-1939: Fallow (during which a hay crop of Red-top grass was cut).
1939-1940: Velvet beans (hay crop).
1940-1941: Sunn hemp (green manure).
1941-1942: Maize (plus 5 tons compost per acre, plus 200 lbs. supers per acre).
1942-1943: Maize (plus 5 tons compost per acre, plus 200 lbs. supers per acre).
1943-1944: Giant Rhodes grass.
1944-1947: Giant Rhodes grass.

Preparation of Land and Method of Planting. The first four acres were planted with young plants from a nursery plot established from seed, but later plantings have all been from seed. The nursery was started with half a pound of seed obtained from the Department of Agriculture. This was sown in October, and the young plants were transplanted on 20th December, and spaced 3 ft. x 3 ft. apart, sufficient plants being obtained to plant four acres. The land was ploughed and harrowed to obtain a fairly fine tilth and then marked out with a maize-planter. Boys then walked up the rows thus produced, digging holes at one-pace intervals with a hoe and planting the roots in them. This operation was carried out under very wet conditions, as R. and I. Faed consider

that the successful establishment of plants from roots is dependent in large measure on weather and soil conditions being just right at the time of planting. Plants should therefore be lifted and planted when the ground is very moist. Fortunately, puddling of the soil is not a problem on sandveld.

As the plants were all in rows, the land was cultivated twice, and by the end of Jahuary the grass had grown sufficiently to allow of a light grazing.

Planting by Seed. When planting by seed it was found advisable to harrow the land twice after ploughing in order to reduce weed growth as much as possible before sowing.

Seeding was done with a fertiliser distributor, the seed having been first mixed with sieved wood-ash in order to obtain a more even distribution. A seeding rate of 5 lbs. per acre was found to give a good cover quickly, and a light grazing was usually possible from six weeks to two months after sowing. This light seeding rate is possible if care is taken in harvesting the seed to ensure a high germinating rate.

Once the seed has been sown, several methods of working it into the soil may be used. R. and I. Faed have tried a light seed harrow, a grass harrow of the chain type and a bush drag made of branches, and found that all three methods gave equally satisfactory results.

Time of Planting. In a season with normal rainfall, planting of both seed and roots can be carried out from the commencement of the rains until the middle of February, the only stipulation being, as has been mentioned before, that the ground should be thoroughly moist, particularly if roots are used.

Fertiliser Treatments. The original four acres planted by roots in December, 1943, received a dressing of complete fertiliser at the rate of 200 lbs. per acre in January, 1944, and were then lightly grazed the same month. In April a light hay crop was taken off it.

In December, 1944, a dressing of sulphate of ammonia (100 lbs. per acre) was applied, but R. and I. Faed did not observe any visible effect from this application, and suggest that this might have been due to excessive leaching caused by the very wet season.

The grass was grazed down well at monthly intervals three times during this summer and not rested for a seed crop.

At the beginning of December, 1945, the pasture received an application of superphosphate at the rate of 200 lbs. per acre, but here again there was no visible effect of the fertiliser. Monthly grazing was carried out as in the previous year, but this summer the grass was rested after three grazing periods and a seed crop of 30 lbs. per acre was eventually harvested.

In September, 1946, a small experiment was carried out with dressings of compost and supers, as follows:—

(a) Part of the pasture received about six tons of compost per acre and half of this area received in addition 400 lbs. of

supers per acre and the other half 225 lbs. of supers per acre.

(b) Part of the pasture received 10 tons compost per acre only.

(c) Part of the pasture received neither compost nor supers and acted as a control plot.

The most striking result obtained from this experiment was the effect of the compost. Those areas which had received compost developed a considerably thicker cover than those without, and the pasture with 10 tons of compost per acre, but no supers, gave more grass than that with six tons of compost per acre, plus supers. No difference in the development of the grass was noted in the two superphosphate treatments. An interesting result was also obtained from two areas which had the compost applied at different times. In one case the compost was applied before the rains, and in the other the compost was spread after five inches of rain had fallen. After 16 inches of rain had been recorded, the pasture which had received its application before the rains had developed a thicker and better cover than the area which received its compost after the rains had started.

The whole of this experimentol area of four acres recently carried 50 head of stock (27 adults and 23 young stock and calves) for seven nights, and at the end of this time the grass was evenly grazed down, but not excessively so.

In March, 1947, the pasture received a dressing of 125 lbs. ammonium nitrate per acre, and when the writer saw it three days later, it had developed a rich, deep green colour, in striking contrast to the surrounding untreated grass. The land was not high in fertility when put down to pasture, and R. and I. Faed feel that ploughing in a green crop, together with a dressing of compost at the time of planting, would improve the growth of the pasture considerably in the initial stages.

Although the only fertiliser effects noticeable to the eye have been produced by compost and ammonium nitrate, it should not be forgotten that phosphates play an important part in the production and formation of seed, and the success which R. and I. Faed have achieved with their own seed may be partly due to this fact.

Grazing Treatments. Some idea of the carrying capacity of the original four-acre paddock may be obtained from the following:

During each summer the paddock usually carried 50 head of stock (half of them adults and half young stock) for four full days each month. Grazing was generally started at the end of December, and then at monthly intervals in January and February. If a seed crop was harvested, a useful aftermath was available in May, but if no seed crop was taken, the paddock was grazed again in early April. In the event of early rains in October, it was usually possible to obtain a light grazing in November. R. and I. Faed are of the opinion, however, that the grazing would be appreciably prolonged if they used a smaller number of cattle towards the end of the rains.

The paddock has always been rested during the winter months since its establishment.

Seed. An important fact to remember is that seed must be dead ripe when reaped. Seed which is partially green when harvested has been found to give a much poorer germination than properly ripe seed, and R. and I. Faed have suggested that this might be one of the reasons why some farmers have not had successful results from plantings of their own seed.

Further Plantings. A year after the first four acres were established, further lands were planted by seed, and, as the germination was excellent, a good cover quickly developed and light grazing was again possible some six weeks later.

In the past season (1946-47) about 50 acres were planted to Giant Rhodes Grass, using Saunders' Upright Cowpeas (20 lbs. per acre) as a nurse crop. The germination was good considering the droughty conditions of the season, and at the time of writing (April) a hay crop had already been reaped and a good aftermath of Giant Rhodes was becoming available for grazing. R. and I. Faed consider that if only one plant of grass per square yard survives, they will, in a year or two, obtain a good cover.

It may be mentioned, too, that sunn hemp sown at the rate of 20 to 30 lbs. per acre has been successfully used as a nurse crop for Giant Rhodes by farmers elsewhere in the Colony. Sunn hemp has the advantage of being particularly effective in keeping down weed growth, an important factor, providing shade and nitrogen for the young grass seedlings and preventing erosion until the grass has covered over. If sunn hemp is used as a nurse crop, it should be cut early for hay to give the Giant Rhodes Grass the opportunity of making good growth and cover before the end of the season.

Future Planting Programme. R. and I. Faed say that in their future cropping programme they plan to establish at least 60 acres of Giant Rhodes each season. They propose using a four-year lay of this grass, to provide improved grazing and hay, in rotation with four years under annual crops (Virginia tobacco, maize and bean crops) and then back to grass.

Some Observations on Giant Rhodes Grass. R. and I. Faed were asked to give their views, as practical farmers, on the value of Giant Rhodes under their conditions and kindly supplied the following notes:—

"The value of Giant Rhodes Grass on sandveld, from the point of view of soil rejuvenation, has not yet been proved, but present indications point to it being a very useful factor in maintaining soil structure and fertility. Ordinary Rhodes Grass has a beneficial effect on the soil, so that Giant Rhodes, which is far more vigorous in its growth, should prove correspondingly more so. It should be remembered, however, that such a vigorous grass as Giant Rhodes must be fed to obtain the best results, both from a pasture point of view and for getting the best results as regards regaining soil structure and fertility. No good farmer expects his crops to grow without being fed some kind of foods, either organic or artificial manure. To obtain a thick stand of Giant Rhodes (and a good stand will contain easily 50 plants to each square yard), it is necessary to feed the grass. From results given in the article by Mr. Rattray, the part played by compost and nitrate of ammonia

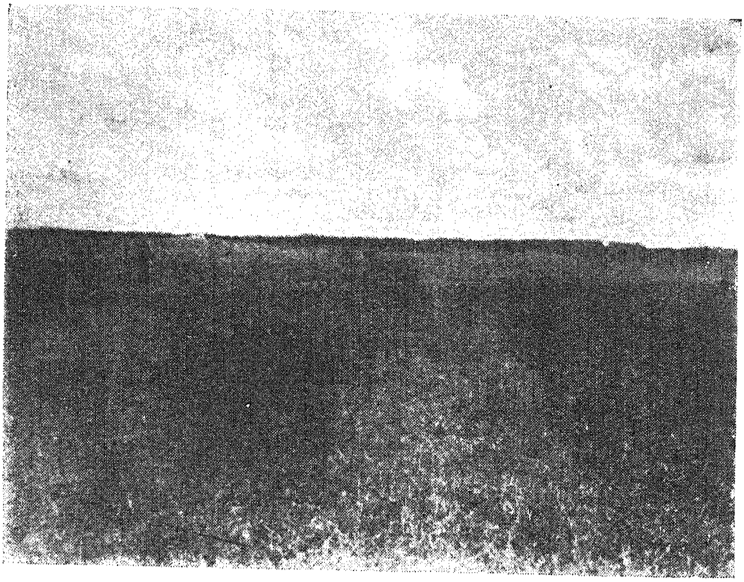


Fig. 1. A four-year-old Giant Rhodes Grass pasture on Ziroto, Trelawney district. Note the excellent cover and freedom from weeds.

[Photo by R. H. Fitt.

Fig. 2. Angus cattle grazing a two-year-old Giant Rhodes Grass pasture on Ziroto, Trelawney district. Note the evenness of the grazing.

[Photo by R. H. Fitt.

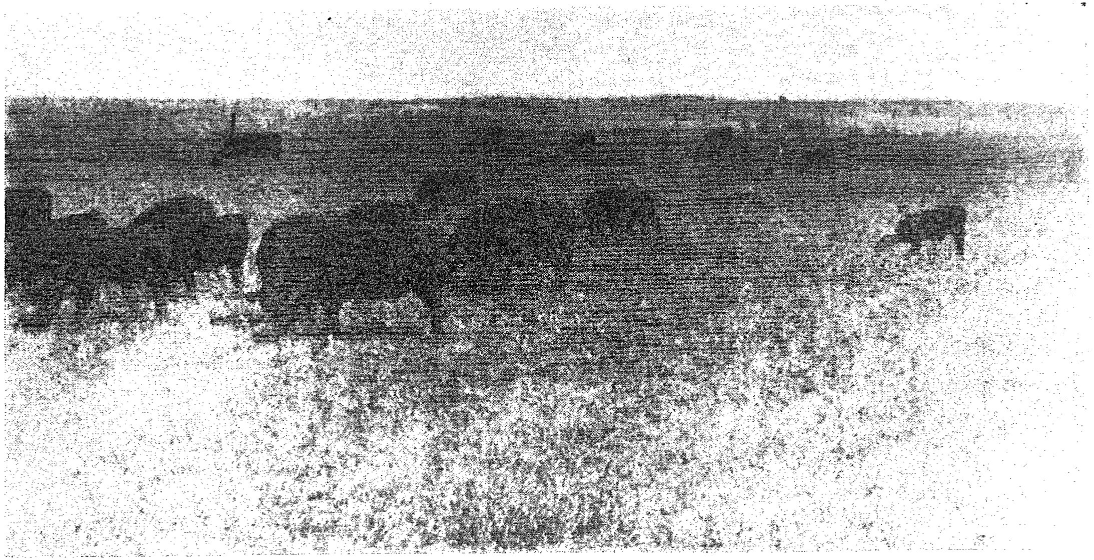


Fig. 3. Angus cattle grazing Giant Rhodes Grass pasture on Ziroto, Trelawney district. The pasture is superior in every respect to veld grazing or land falling back to grass.

[Photo by R. H. Fitt.

is beyond question. To anyone who intends planting Giant Rhodes purely to 'bring back' the soil, it will certainly be necessary to plough under a green crop before sowing the grass, if good results are to be obtained for a year or two, and more especially so if no compost or artificial fertiliser is applied after the grass is established. Light grazing will help the grass to cover the ground more quickly, by causing each plant to send out runners, which strike easily in the wet season.

"To date, none of our pastures has yet been ploughed up, because the land has not yet been required; also, most of the land put down to Giant Rhodes has been under cultivation for at least eight years and may require a considerable period under grass to regain the soil structure, which is so easily lost in sandveld.

"It is our opinion that Giant Rhodes has a great part to play in the future of sandveld farming. The following points are some which show up the merits of Giant Rhodes:—

(1) It can be sown from seed or planted from roots or runners.

(2) It forms a good cover if well treated.

(3) It is extremely vigorous and is not smothered by any other grass, even couch.

(4) It is a great force against soil erosion.

(5) It should have a good effect on water supplies by holding up excessive rain and allowing it to penetrate the soil.

(6) It has an excellent root system, which should improve soil structure and aeration.

(7) It is an excellent pasture grass and well liked by stock.

(8) It is easily killed by ploughing in the dry season, so that no fears need be held about it becoming a nuisance.

(9) As far as is known, it does not harbour eelworm, so can be used in tobacco rotations.

"In conclusion, we should like to compare the reverting of old lands to permanent grass, as compared to Giant Rhodes. In lands which have been cultivated for, say, five years, it takes many years —eight or nine—for the permanent veld grasses to form a complete cover; in the case of a sown grass like Giant Rhodes, a useful cover can be obtained in the first year, and an excellent cover can be expected in three years at the maximum; in most cases two years is sufficient. It can easily be seen, therefore, what an important part Giant Rhodes can play in controlling soil erosion, increasing underground water supplies, and improving the productivity of the land."

In concluding these notes, I must mention that the Giant Rhodes Grass pastures on Ziroto form a most attractive feature of the farm. This grass certainly is well suited to the conditions there and appears already to be playing a useful role in the farming system. It offers promise of being even more useful in the future. While soils and climate at Ziroto are undoubtedly favourable for the growth of Giant Rhodes Grass, the success which R. and I. Faed have had with it is largely due to their careful and thorough methods of laying down the pastures, and in their subsequent management of them.

Some Hints for Anglers on Fish Pests.

By R. H. R. STEVENSON, F.R.E.S.

As indicated by the title, this paper is only meant to give interested persons some idea of the animals which are actually deleterious to fish in Southern Rhodesia, and also of those which live in or near waters where fish are preserved for angling purposes, but are not sufficiently harmful to warrant their destruction or persecution. There are many persons besides fishermen (and I like to think that most fishermen themselves) who are interested in the bird life of the rivers and waters which they visit for fish preservation or angling purposes. So many birds especially are blamed for doing damage to fish, without any facts being studied beyond the one that they live near the water. Herein I will attempt to give my readers the benefit of a lifelong experience and study at first hand of our water birds, and some other animals, and indicate those which are unjustly blamed and which, in my opinion, should be destroyed or frightened off.

In fish hatcheries, naturally, no fish-eating bird is welcomed, and they should be scared off with a charge of dust-shot at long range, or destroyed where absolutely necessary.

Perhaps the most destructive fish predators are the Otters, the CAPE OTTER (*Lutra capensis*, Schinz) and the BROWN OTTER (*Lutra maculicollis*, Licht). Some of my friends differ in this opinion, and otters certainly kill many crabs, frogs and water-snakes, but they also kill many fish. I have watched a big dog otter haul out a large eel on to the bank at Lake Funduzi, in the Northern Transvaal, eat a portion of the back and leave the rest, where the remains were promptly pounced upon by a fish eagle. It was too heavy even then for this powerful bird to carry away and weighed 15 lbs. Lately, the Selukwe Piscatorial Club lost two 4 lb. Black Bass from their breeding pond. The spoor of otters showed where they had gone, and one was wounded just afterwards. They have not been seen again. Otters are easily scared off. They seem to travel up and down watercourses and are often seen in rivers in the early mornings and evenings. If they take up their quarters near waters where bass are propagated, a charge of shot will settle matters one way or the other and they will shift their quarters forthwith. They are certainly very common animals in Southern Rhodesia, judging by the spoor seen on the banks of all rivers and most dams. No other four-footed animal is much

danger to fish life in South Africa, with the exception, perhaps, of the WATER MONGOOSE (*Herpestes cratera*, *Erxleben*, Davison). Occasionally a domestic cat developes a taste for fishing, but I do not advocate that all domestic cats should be shot on sight, even for bait.

Now for the Birds. The three Pelicans: PINK BACKED PELICAN (*Neopelicanus rufescens*, Gm), EUROPEAN PELICAN (*Pelicanus onocrotalus*, Lin) and ROSY PELICAN (*Pelicanus roseus*, Gm) listed in Dr. Roberts' excellent book, certainly live on fish, but are so rarely seen in Southern Rhodesia and have such interesting habits and form, that I think it would be a shame to kill one of them. Their interest greatly outweighs the damage they do, and unless on a hatchery water or breeding poól, they should not be molested.

Another bird who picks up an occasional small fish is the LAKE TERN (*Chlidonias leucoptera*, L) but its chief prey are insects, of which it devours numbers.

The Peters Finfoot and the three Grebes, known respectively as CAPE DABCHICK (*Poleocephalus capensis*, Salvad.), EARED GREBE (*Proctopus nigricollis*, Brahm), CRESTED GREBE (*Podiceps infuscata*, Salvad.) and the PETERS FINFOOT (*Podica petersi*, Harte), all eat fish. The CAPE DABCHICK is perhaps the best known bird amongst fishermen. His dive has often been mistaken for a rising fish, and one looks out for his reappearance yards away from where he went down. I have only found small crabs and insects in those I have examined, but they are said to take small fish, too. Except on fish breeding pools and hatcheries, I should not molest them, for the harm they do cannot be very extensive.

The other Grebes and the Finfoot are rare birds here and should be preserved when seen. They are easily differentiated from the Snakebird by the shape and carriage of their necks. I think the Finfoot eats more insect life than fish, but the Grebes are fish eaters, with an occasional frog or tadpole thrown in. Nevertheless, I would have them protected by law as rare birds.

The bird which, in my opinion, should be shot on sight is the so-called South African DARTER or SNAKEBIRD (*Anhinga rufa*, L. & D.). This bird lives mainly on fish and has an inexhaustible appetite. Its prey is taken under water with an effortless dive from the surface The actual propulsion under water is made with the feet, the tail being used with the beak for steering and the wings are kept tightly folded to the sides (Bent). The prey is generally speared with the sharp-pointed bill, which has saw-like serrations on its inner surface which hold the slippery prey whilst being swallowed. The bird can be easily distinguished from others like it (Cormorants, Grebes and Finfoot) by its peculiarly bent neck, heron-like head and beak, the rusty colouring of the sides of the

neck and its almost complete submergence when swimming, only the neck being visible, especially when trying to escape notice by swimming away. It seems to have the almost fish-like ability of regulating its depth of swimming, and I have noticed them so deep in the water that only the top of the head and beak were showing on the surface. Neither the Grebe nor the Finfoot has the sharply-angled bend of the neck, which is shown in the herons to some extent. The bird has a most voracious appetite, and is said to consume up to 40 lbs. weight of fish daily. Of the American species of *Anhinga* called the WATER TURKEY, which is very like our own and about the same size, Andubon (1840) states that he found in the stomachs: "fishes of various kinds, aquatic insects, crays, leeches, shrimps, tadpoles, eggs of frogs, water lizards, young alligators, watersnakes and small terrapins"—certainly a varied bill of fare. He also relates where he gave one "a blackfish, 9½ inches long by 2 inches in diameter, and although the head of the fish was considerably larger than its body and its strong and spinous fins appeared formidable, the bird, which was then about 7 months old, swallowed it entire, head foremost." After digesting this for 1½ hours, it swallowed three others somewhat smaller. "At another time, we placed before it a number of fishes about 7½ inches long, of which it swallowed nine in succession. It would devour at a meal 40 or more fishes about 3½ inches long." Bent says "fish undoubtedly form the principal part of this bird's diet."

Fish too large to swallow are sometimes killed and left to the crabs, and I have seen badly wounded fish, evidently struck by the dagger-like beak, which have escaped in a maimed condition.

It will be seen by these observations that the DARTER is our worst fish enemy, and that it should be put on the vermin list, and where fishing societies are trying to bring imported fish to maturity, a reward for every bird and egg destroyed would perhaps help.

Next on the list of fish pests are the CORMORANTS, of which only two species need be mentioned here. The others are sea-coast dwellers. The WHITE BREASTED CORMORANT (*Phalacrocorax lucidus*, Licht). This is a more robust bird than the Snakebird, but is not nearly so common on our waters. It has a more curved, hooked beak which is darker than the latter's, a white breast, neck and throat with a yellowish gape. When it is found in large numbers (although I have personally never seen them thus) it must do a tremendous amount of damage to fish life. It pursues its finny prey under water like a Snakebird and comes to the surface to swallow it, at least when the fish is large. It can easily swallow fish of over half-pound weight, and I have taken a bream out of one measuring over 6½ inches. The opportunity to post-mortem these birds has not been frequent, as I have only occasionally seen them. They also eat platannas and frogs, and are said to be partial to eels. I certainly found a partly digested head of one fish which must have belonged to an eel over 12 inches long. It appears to breed only near the coast; according to Roberts, "on rocks in October and January and inland on trees standing in the water in mid-winter (June)." If it appears on preserved waters

where fish are being acclimatised, I think it should be destroyed or at least driven off, as, judging by data from various sources, the Cormorant's appetite is no less insatiable than the Snakebird's. It should also be declared vermin.

The REED CORMORANT (*Microcarbo africana africanoides*, Smith) is the common Black Cormorant seen on all our waters and well known to all fishermen. This is a smaller bird altogether than the last-mentioned, and from the evidence supplied me by Dr. Louis C. Thompson, of Haenertsburg, who has examined the crops of many shot in the Northern Transvaal, and my own experience, this small Cormorant feeds mainly and almost solely on platannas. As I intend later on to refer to these slimy pests and their insatiable greed when it comes to young fish, I will not now enlarge on it; but if this predelection for platannas as food is conclusively proven, the Reed Cormorant should be regarded as a friend.

I made this list of the contents of one stomach shot in the Surprise Dam in January:—

Heads in various stages of digestion of 6 platannas,

3 large water beetles (*Cybiscus*),

2 large water scorpions,

3 snails,

some slimy green water weed, and

1 dragon fly larva.

Dr. Thompson insists that he has only found platannas.

It is here that Secretaries of Fishing Societies could help, and get their members and fish wardens to take out the crops or stomachs of all birds shot as fish enemies, put them into a pickle jar with 5 per cent. Formalin and forward them to their nearest museum or the Agricultural Department for examination. If this bird turns out to be as useful as it seems, the fact should be given all the publicity possible.

The Herons are better known to the general public. Their graceful appearance and quiet dignity seem to compel admiration, but it is well known that the GREY HERON (*Ardea cinerea*, L), the BLACK HEADED HERON (*Ardea melanocephala*, V.C.), GOLIATH HERON (*Ardeomega goliath*, Gretschm), PURPLE HERON (*Pyrrherodia purpurea*, L) and the GREAT WHITE HERON (*Casmerodius albus melanorhynchus*, Wagl), all eat fish. The Grey Heron and the Black Headed Heron, being the commonest, are probably the worst offenders in this direction, but I think their staple diet consists more of frogs, snails and crabs than fish. They are naturally not to be encouraged round a hatchery or breeding pond, but otherwise it seems a pity to destroy them. A dose of 12's at about 40 yards would frighten them enough to keep them off without doing them any harm.

The Egrets mostly feed on insect life and small water animals, and are certainly too beautiful to be destroyed at any time. The YELLOW-BILLED EGRET (*Mesophoyx intermedia brachyrhyncha*, Brehm) is the only one which feeds habitually in the water and does occasionally take fish near the banks. The SQUACCO HERON (*Ardeola ralloides*, Sesp), GREENBACKED HERON (*Butorides striatus atricapillus*, Afz), BLACK HERON (*Melanophoyx ardesiaca*, Wagl), RUFUS HERON (*Erythrocnus rufiventris*, Sund), RAIL HERON (*Ardeiralla sturmi*, Wagl), the little BITTERNS (*Ixobrychus minutus*, L) and (*I. Payesi*, Hartl) are too rarely seen to be disturbed, and the few small fish they eat does not duly upset any fisherman's dream of a full basket.

I am only including the HAMMERHEAD (*Scopus umbretta*, Lin.) in this list to affirm its absolute innocence as far as a fishing bird is concerned. Tadpoles, frogs and small water animals are its usual dish. Dr. Davison says it will eat fish stranded or in small pools, and so will most water birds.

The Storks are all innocuous as far as fish are concerned and get their food mostly on land, but the OPENBILL (*Anastomus lamelligerus*, Temm), a rare visitor, is said to eat small fish.

The SACRED IBIS (*Threskiornis aethiopica*, Lath) feeds on small water animals and crustacea and will kill and eat quite a large crab, but is innocent where fish are concerned.

The AFRICAN SPOONBILL (*Platalea alba*, Scop.) is one of our most interesting birds and fascinating to watch spooning up the mud to catch the tiny animals living therein, but it does not eat fish.

The FLAMINGOS (*Phenicopterus ruber*, L) and (*Phoeniconaias minor*, Geoffr.) might eat fish spawn to some extent, but are much too few and far between to do any harm, and should be rigidly protected.

Amongst the ducks are many who live on fish, and the inhabitants of waters where fish exist, but as they themselves serve a useful purpose for sport, I think their presence should be encouraged except in breeding pools and hatcheries. The more harmful ducks are the diving ducks, such as the POCHARD (*Nyroca erythrophthalma*, Neuwied) and the MACCOA (*Cerconectes maccoa*, A. Smith). The latter is not a common duck and is very seldom seen in flocks.

Of the birds of prey, only two species concern us here, the FISH or CAPE SEA EAGLE (*Cuncuma vocifer*, Daud) and the OSPREY (*Pandion halietus*, Lin.). I think all fishermen will agree that these two glorious birds should be protected. They live generally in areas where few people want to preserve fish and are all too rare. A never-to-be-forgotten thrill is to see an Osprey plunge on to its prey in a splash of water, emerge with a large fish in its claws, and with heavy beats of its wings, it manages to reach some favourite rock or tree, there to enjoy its meal in comfort. I

have not yet encountered a fisherman who wanted to see one shot after experiencing such a sight or who did not talk about it afterwards. Mr. Davison says that they take heavy toll of young crocodiles up to 2 feet long. (See Section under Crocodile.)

On a recent visit to the Mtshandig Dam I heard complaints about the fish-killing propensities of the Fish Eagles, of which there are several pairs nesting around or nearby this—from a Southern Rhodesia viewpoint—magnificent sheet of water. Their shrill scream and the continuous "quackle" of the Egyptian Geese so common there were sounds I personally should hate to have missed. I was informed by the Chairman of the local Angling Society that the eagles were catching large Bass, but it is just these large Bass that can best be spared. If they eat young crocodiles and a few of the large barbers or catfish in the dam, I feel they are doing more good than harm, and I was happy to see that no shooting was allowed. I think, however, that the crocodiles should be exterminated somehow, either by shooting by responsible persons or poison.

As far as PELS FISHING OWL (*Scotopelia peli*, Temm) is concerned, I confess to absolute ignorance. I have heard them on the Matetsi River, and a more unearthly noise I cannot imagine. In any case, they are not likely to interfere with anglers' sport, as they seem to keep to the most inaccessible waters. The CRAKES and RAILS, although water-loving birds, do not eat fish. They feed on vegetation and insects. The AFRICAN COOT (*Fulica cristata*, Gm) comes into the same category and definitely does not eat fish. PETERS FINFOOT (*Podica petersi*, Harte) which might be mistaken for a Snakebird, is easily distinguished by its shorter, thicker neck, red beak and dark colouring, especially the cock bird. It is a real skulker, keeping to the sides of the rivers and streams it frequents. It lives entirely on small animals such as crabs, small fish, snails, dragon fly larvae and the seeds and berries of plants in or near the water. It should be rigorously protected.

CRANES are not, in any case, fish-eaters. Although often seen near ponds and rivers, they find their food mostly on land.

The JACANAS (*Actophilornus africanus*, GM) and (*Microparra capensis*, A. Smith) feed on water insects, flies and such small life as exists on floating water plants. They certainly do not molest fish in any way. The same can be said of the Snipes and Sandpipers and Plovers.

The only member of the Laridae which occurs in Southern Rhodesia is the GREYHEADED GULL (*Hydrocolocus cirrocephalus*, Vieill), which is a rare visitor to the larger waters, cannot be considered as a nuisance in any way; rather as a welcome stranger. These birds take small fish, but are too scarce to be molested.

The AFRICAN SKIMMER (*Rynchops flavirostris*, Vieill) occurs on the larger rivers and dams, but feeds only on minutae picked up by the narrow lower beak.

There remains now only the KINGFISHERS. These beautiful birds are certainly fish eaters in most instances, but it is open to discussion as to whether they should be shot or not. In the case of the GIANT KINGFISHER (*Megaceryle maxima*, Pali), which certainly lives on fish and can swallow a half-pound trout. (This I have personally seen and can vouch for, and other cases where quite largish fish have been killed and eaten.) He should not be allowed to live near a hatchery or breeding pool, and, with the PIED KINGFISHER (*Ceryle rudis*, L), must be killed off where trout, bass or blue gills are stocked. They are very common all over Rhodesia and would not be in danger of extinction if shot near fish preserves.

The HALF COLLARED KINGFISHER (*Alcedo semitorquata* Swains), the MALACHITE CRESTED KINGFISHER (*Corythornis cristata*, Vroeg), NATAL KINGFISHER (*Ispidina picta natalensis*, A. Smith), ANGOLA KINGFISHER (*Halcyon cyanoleucus*, Vieill), the MANGROVE KINGFISHER (*Pseudhalcyon pallidiventris*, Cab), all take small fish, but personally I am of the opinion that the small fish they take do not interest the fisherman, being mostly the fry of small *Barbus* sp. and mouth breeders, and their friendliness and beauty more than compensate the fisherman for any loss of fish he might imagine they incur.

As far as the BROWN HOODED KINGFISHER (*Chelicutona albiventris*) and the STRIPED KINGFISHER (*Chelicutia chelicuti*, Stanl) are concerned, it is an established fact that these only live on insects and small animals picked up off the ground.

(*To be continued*)

The Dairying Industry.

By J. R. CORRY, B.Sc., Ag. Chief Dairy Officer.

A considerable number of enquiries have been received recently for information in connection with the dairying industry in Southern Rhodesia, and it is felt, therefore, that an article furnishing miscellaneous information on this subject might serve a useful purpose. Most of the enquiries are for information in regard to the following, viz., the outlook for dairying in Southern Rhodesia and the suitability of the Colony for this type of farming, the markets available for dairy produce and prices obtainable for milk, cheese and butterfat, location of creameries and factories, levies and control measures in force, dairy regulations, etc. As far as possible, these questions are answered in the following article:—

1. **Prospects for the Dairying Industry in Southern Rhodesia.** On the whole, the outlook for the dairying industry seems fairly bright. At present the Colony is a long way from producing sufficient dairy produce for its own requirements. This applies particularly to butter and cheese, whilst other products such as dried milk and condensed milk are not being manufactured here at all. As far as butter is concerned, it is unlikely that the Colony will be producing sufficient for its requirements for some years to come, whilst resumption of the trade with adjoining territories, which existed before the war, will probably not be possible without considerable expansion in the industry.

The fact that there is a shortage of dairy products in the territory, coupled with the steadily increasing demand for milk and its products, due to the Colony's rapidly growing population, makes it unlikely that the Colony will be exporting dairy products for many years to come, and the industry will not therefore be exposed to the possibly depressing effect of international prices. Viewed from this angle, the immediate future for dairying seems bright enough. There is obviously room for expansion.

2. **Areas Suitable for Dairy Farming.** Southern Rhodesia is essentially a pastoral country, and it is not surprising, therefore, to find that dairying in some form or other is carried out in most parts of the Colony, although certain areas are probably more suitable for this type of farming than others. Generally speaking, the minimum requirements for successful dairy farming in this country are a fairly cool climate, good soil and a rainfall of not less than 25 inches per annum. Rigid adherence to these physical controls, however, would probably restrict dairying in this Colony to altitudes of 3,500 feet and above, whereas there are exceptions to this rule. As in most undertakings, however, the human element is an important factor, and a great deal depends on individual care, feed and management, as well as intelligent adjustment of farming methods to suit the climatic and other controlling factors. At the same time it must be admitted that Southern Rhodesia does

not possess the natural features and facilities for dairying which exist in countries such as New Zealand, parts of South Africa and Kenya Colony. Southern Rhodesia lies almost wholly within the tropics and has a summer rainfall, the bulk of the rain falling during December, January, February and March. The natural pastorage is, on the whole, somewhat inferior and, with a few exceptions, inadequate for the maintenance of milk production for more than a few months of the year; supplementary feeding is therefore usually necessary for seven or eight months of the dairying season, the feed most commonly grown for this purpose being hay—leguminous and otherwise—silage, usually maize or sunflowers and concentrates such as maize, beans, ground nuts, etc. The extent to which supplementary feed can be provided, and the acreage planted annually for this purpose, depends on the quality of the soil, rainfall, etc. As a rough estimate, however, it can be assumed that a dairy cow producing 500 to 600 gallons of milk in a lactation of 300 days or less will require as supplementary feed about 3 tons of silage, 1 ton of bean hay and at least ½ ton of concentrates per annum. This means that approximately 2 acres of land will require to be planted each year for feed for each cow in the herd.

If the natural grazing is exceptionally good, or where improved pastures can be laid down, this figure may be considerably reduced.

Notwithstanding the Colony's lack of natural facilities for dairying in the way of good pastures, etc., it is possible, under conditions of good management and where adequate provision is made for supplementary feeding to maintain dairy herds of quite a high standard of production, i.e., an average herd of production of 700 to 800 gallons of milk per annum, is by no means uncommon, whilst these figures are frequently exceeded by individual cows. The following figures show the herd averages for cows recorded under the Southern Rhodesia Government Milk Recording Scheme during the past few years:—

Year.	Lbs. Milk.	Lbs. Butterfat.	No. of Days.
1941-42	5,622	205	280
1942-43	6,161	226	285
1943-44	6,252	231	283
1944-45	6,050	221	278

The most popular breed for dairying purposes is the Friesland —grade and pure-bred—although the Red Poll, Guernsey and Jersey are also favoured. All four breeds do well.

3. **Labour.** From a dairying point of view, the indigenous labour, although cheap, is untrained and consequently inefficient. Due to his low standard of living and lack of knowledge and appreciation of the elementary principles of hygiene, the African is unable to grasp the significance of the various precautions which have to be taken in the production and handling of dairy produce. This is a distinct handicap, as so much of the dairy work is left to the

African employee. Under constant supervision, however, the more intelligent African can be used with a considerable degree of success, and where farmers are prepared to exercise such supervision and training, satisfactory results can be anticipated. As above mentioned, African labour, although inefficient, is cheap and can usually be procured for wages ranging from 25/- to 35/- or more per month, plus, of course, food, etc. The labour staff required for herding, milking, feeding, handling and transport of the milk and cream, etc., usually works out at about one African for every five cows, e.g., for a herd of 100 cows a staff of approximately 20 Africans would be required; some of these would, of course, be used for other work on the farm besides the tasks mentioned.

4. **Dairy Buildings and Equipment.** Under the Dairy Regulations, every person selling dairy produce has to provide himself with a suitable milking place and a dairy. Under the climatic conditions which obtain in Southern Rhodesia, however, it is practicable for dairy cattle to remain out day and night throughout the year, and consequently elaborate cow stables such as may be required in colder countries are not necessary here. A simple lean-to shed where the cows can be milked and fed is quite satisfactory and can usually be constructed quite cheaply; the milking place must, of course, have a cement floor and comply in other respects with the Dairy Regulations. The dairy, which usually consists of one or two rooms, can also be erected very cheaply—in fact, the writer has seen some very excellent small single-room dairies constructed for less than £10. All farm dairy equipment, such as utensils, boilers, steam sterilisers, etc., can be obtained without difficulty in the Colony. Drawings of dairy buildings, etc., can be obtained free of charge from the Chief Dairy Officer, Box 387, Salisbury.

Milking Machines. Owing to the difficulty in obtaining good native milkers in the territory, dairymen are turning their attention to the possibilities of machine milking, and there is little doubt that in spite of the fact that they are somewhat costly to instal, milking machines will ultimately become an important factor in advancing the dairying industry in the Colony—in fact, as the dairy heards improve, they may become a necessity. Experiments have shown that they are economical to operate, have no appreciable effect on the yield or composition of the milk, and are unquestionably preferable to the average type of African hand milking.

5. **Markets for Dairy Produce.** Milk may be disposed of in the form of fresh milk if the farmer is near enough to a town or village to market his product in that form, or it may be supplied as whole milk to a cheese factory or as butterfat to a creamery; it may also be converted into cheese by the farmer himself. The manufacture of butter on farms, however, is not encouraged—in fact, no farmer can make butter unless he holds a farm butter licence issued to him by the Dairy Industry Control Board. New comers to the industry have little hope of obtaining a licence to make farm butter unless they are so situated that they are unable to send their cream to a creamery. Producers who are situated within 12 miles of a thrice-weekly rail or road motor service are usually regarded as being able to send cream to a creamery and are not granted a licence to make farm butter.

The object of this measure is to encourage producers to send their cream to the creameries, which are properly equipped with the facilities necessary for the manufacture and storage of butter of uniform quality.

6. **Situation of Creameries and Cheese Factories.** There are four registered creameries in the Colony, one each at Umtali, Salisbury, Gwelo and Bulawayo; of these the only fully co-operative creamery is the factory at Bulawayo. These creameries, which are situated on the main railway running from the Western to the Eastern Border of the Colony, are well served in the matter of rail transport, as it is possible for farmers situated along this route to send their cream daily to the creamery if they wish to do so. Transport facilities on the branch lines are also fairly satisfactory, whilst railway road motor services operate on most routes not served by rail transport. In fact, there are only a few areas from which cream cannot be delivered to a creamery in satisfactory condition—provided, of course, that it is produced and handled in the proper manner.

There are six cheese factories presently operating in the Colony; of these, one is situated at Chipinga, one at Fort Victoria, and one each at Umtali, Salisbury, Gwelo and Bulawayo. The factories at Chipinga, Salisbury, Gwelo and Bulawayo are all co-operative; the other two factories are privately owned. These factories between them manufacture about 80 per cent. of the Colony's output of cheese.

The chief varieties of cheese made are Cheddar and Gouda, mainly the former. Roquefort cheese, familiar to most people as a blue-veined cheese, is made by the factory at Fort Victoria. In addition to these varieties, small amounts of soft cheese such as cream cheese, cottage cheese and certain other types are also made in the Colony.

As far as the fresh milk trade is concerned, this shows a strong co-operative trend. In both Salisbury and Bulawayo the bulk of the fresh milk sold is handled by co-operative companies owned by the producers, whilst in Gwelo and Umtali the organisation is even stronger, being almost 100 per cent. co-operative.

7. **Prices of Dairy Produce.** The wholesale and retail prices for creamery butter and the minimum prices payable by the creameries for butterfat, as well as the wholesale and retail prices for Cheddar and Gouda cheese, are fixed by the Southern Rhodesia Dairy Industry Control Board. Current prices are as follows:—

	s.	d.	
Creamery Butter—			
Retail Price	2	6	per lb. (1st Grade)
Wholesale Price	2	3	per lb. (1st Grade)
Butterfat—			
Summer Price (usually 4 months, Jan.-April)	2	0	per lb. (1st Grade)
Winter Price (usually 8 months)	2	10	per lb. (1st Grade)
Cheese (Cheddar and Gouda)—			
Retail Price	2	0	per lb. (1st Grade)
Wholesale Price	1	8	per lb. (1st Grade)

The prices paid for butterfat vary with the season, i.e., from summer to winter, but the wholesale and retail prices of butter remain unchanged throughout the year.

In addition to the fixed prices for butterfat, which averages over the year at about 2/5 per lb. for 1st Grade, the creameries usually pay a small bonus ranging from 1d. to 3d. per lb. There is also the special Dairy Bonus of 4d., to which reference is made in the appendix. Generally speaking, milk which is separated for the purpose of supplying butterfat to a creamery is considered to be worth 1/- to 1/2d. per gallon.

There is no fixed price for cheese milk, the value of which varies from 9d. to about 1/3d. per gallon, plus the special Dairy Bonus of 1d. per gallon.

Prices for fresh milk sold in all municipal areas are at present fixed as follows:—

Credit Price—4¼d. per pint.

Cash Price—4d. per pint (for 1 pint only).
3¾d. per pint (for 2 pints or more).

Sold in quantities of 1 gallon or more—2/4d. per gallon.

These prices obtain within a radius of 7 miles of the Post Office in each of the towns concerned.

8. **Dairy Legislation and Control Measures.** Control of the dairy industry is exercised under the Dairy Act of 1937, which not only makes provision for the regulation of the industrial side of the industry by the establishment of a Dairy Industry Control Board, the collection of levies and payment of bounties on dairy produce and the registration of creameries and factories and grading of dairy produce, but also for the regulation of all public health aspects of the industry, such as the registration and inspection of urban and rural dairies and the enforcement of standards of quality, composition, etc., for all dairy products.

The Dairy Industry Control Board. The interests of producers, creameries and cheese factories, as well as the interests of consumers, are all represented on the Dairy Industry Control Board constituted under this Act.

This Board has wide powers and important functions. It is empowered, for instance, to impose and collect levies on all butter and cheese made in or imported into the Colony and to pay from these levies, bounties on butter and cheese exported or sold in the Colony; it may also use levy funds for stabilising prices of dairy produce, reducing production, manufacturing and marketing costs, encouraging the greater consumption of dairy produce, and assisting and encouraging dairy research; the Board has power also, subject to the approval of the Ministry of Agriculture and Lands, to fix minimum prices for butterfat and for milk supplied to cheese factories, condenseries and dried milk factories, as well as the wholesale and retail prices of butter and cheese; the Board has power also to import, purchase, store, sell and re-export butter and cheese, and may compel others to export if necessary. The Board is also the licensing authority for farm butter makers, and

it advises the Minister of Agriculture generally on all matters relating to the development and welfare of the dairy industry.

At the present moment no levy is being collected on butter or cheese.

Registration of Factories—Grading of Dairy Produce. All creameries, cheese factories, condenseries and dried milk factories have to be registered with the Department of Agriculture, and before registration can be effected, such premises have to comply with certain minimal requirements in regard to construction, accommodation, appliances and equipment. These factories are subject to frequent inspection by the Dairy Officers of the Department of Agriculture. No butter or cheese may be manufactured in a butter or cheese factory unless there is at least one person working in the factory who holds a certificate of proficiency in butter-making and cheese-making. This also applies to the grading and testing of milk and cream, i.e., no person may carry out these duties in a factory or creamery unless he holds a grading or testing certificate. All these certificates of proficiency are issued by the Chief Dairy Officer, who must first satisfy himself that the persons concerned have a sufficient knowledge of the work or duties for which the certificates are required.

All cheddar cheese has to be graded by a Dairy Officer before it can be sold. All cream delivered to a creamery for manufacture into butter has to be graded into one of four grades corresponding with the grades of the butter into which the cream is converted. All packages containing creamery butter must be marked on the outside with words indicating the grade of the contents; all creamery butter is liable at any time to inspection and grading by a Dairy Officer, and this also applies to farm butter; packages containing farm butter have to be marked with the words "farm butter" and with the name and address of the producer.

Farm Butter. As previously mentioned, no person can make and sell farm butter in the Colony unless he holds a farm butter licence issued to him by the Dairy Industry Control Board. The Board, however, can only issue licences to certain persons, viz., producers who were engaged in and had built up a high class business in butter-making before the Dairy Act came into force, or who are so situated that they cannot supply cream to a creamery or else are dairying in a remote area where the making and sale of farm butter is in the interests of the local community.

All farm butter licences expire on the 31st December in each year, but are renewable; these licences are also subject to such conditions as the Dairy Board may attach thereto, viz., the Board may restrict the sale of farm butter by any person to a particular area or may limit the quantity which may be sold, etc.

Registration and Inspection of Urban and Rural Dairies. All dairy premises throughout the Colony from which milk, cream, butter, cheese or ice-cream is sold or supplied for sale must comply with certain minimal hygienic requirements and are subject to inspection by a dairy inspector who may be either a Dairy Officer, a Municipal Health Officer or a Government Medical Officer. In addition, all dairy premises from which milk or cream is sold, for

consumption as whole milk or cream, in a municipal area or area controlled by a Town Management Board, have to be registered. In the case of Bulawayo, registration has to be effected with the municipality; in all other cases registration has to be effected with the Chief Dairy Officer unless the premises are actually situated within the Municipality or Town Management Board area, in which case registration must be effected with the local authority.

Dairies which do not supply milk or cream for consumption as whole milk or cream in a Municipal or Town Management area, i.e., farmers supplying cream or milk to a creamery or factory, do not have to be registered.

In addition to the minimal hygienic requirements which apply to all dairymen throughout the Colony, dairies which are registered with the Salisbury and Bulawayo Municipalities have to comply with certain special requirements in the way of buildings, hygiene and equipment. Information on this matter can be obtained from the local authorities concerned.

As previously stated, all dairy producers, including cream suppliers, farm butter-makers, farm cheese-makers or suppliers of milk to cheese factories, have to comply with certain minimal requirements, chief amongst which are the following:—

(1) Milking operations must be carried out in an approved milking place, which includes a properly constructed cowshed, a simple lean-to shed with a concrete floor or an open milking kraal with a concrete or earthen floor; such kraal must, however, be kept solely for milking, i.e., cattle may not be kept therein at night.

(2) The milking place must be situated at least 300 feet from any residential quarters and at least 100 feet away from any other kraal, unless permission to the contrary is given by a Dairy Inspector.

(3) The milking place must be kept clean, and any manure deposited therein must be removed daily.

(4) Milking operations must be carried out in a cleanly manner, i.e., the cows must be clean when milked and the milkers must wash their hands before milking each cow, and a supply of clean water, receptacles, soap, cloths and towels must be provided for this purpose. If it is necessary to tie the hind legs of the cow, then proper metal cow hobbles—and not reims—must be used for this purpose.

(5) All utensils, cans, milk buckets must be of seamless construction.

(6) Facilities must be provided for the proper cleaning and sterilisation by steam or boiling water of all dairy utensils.

(7) A special dairy room must be provided which can be used for the straining, cooling and storage of milk and cream and for the making of dairy produce or for housing dairy utensils. This room may not be used for any other purpose, such as storing meat, vegetables, etc. The dairy must have a cement floor, and be fly-proof and rat-proof and well ventilated; it must be so constructed, also, that it can be

thoroughly cleaned and disinfected when necessary; it must also be provided with a ceiling of some kind.

(8) The dairy must be situated at least 100 feet away from any milking place or privy.

(9) All drainage and refuse from dairy premises must be disposed of in a manner approved by the Dairy Inspector.

(10) Except with the special permission of a Dairy Inspector, no person may keep pigs within 300 feet of any dairy building.

(11) Manure or other offensive matter must not be allowed to accumulate within 300 feet of any dairy building or milking place.

In addition to the above requirements, there are various other regulations affecting the sale and disposal of milk from sick or diseased cows, the employment of unhealthy personnel, etc.

Standards of Composition for Dairy Produce. The following are the main composition and quality standards for dairy products:—

Milk. Milk must contain not less than 3 per cent. of milk-fat and not less than 8.5 per cent. of solids not fat. It must also be free from the tuberculosis germ and must satisfy the requirements of the Methylene Blue Test.* This test is based on the fact that the bacteria in milk possess the ability to decolourise Methylene Blue dye. One millilitre of a standard solution of the dye is added to 10 millilitres of the milk to be tested, which is then kept at a temperature of 99-100 degrees F. until the blue colour disappears. The rapidity with which the milk turns white is considered to be an indication of the number and the activity of the bacteria present, and consequently of the conditions and methods of production. The standard laid down is that milk must not decolourise Methylene Blue within four hours in the case of samples taken during the months of October to the following March; from April to September the standard is five hours.

Pasteurised Milk. Must comply with the above standards and in addition must comply with the Phosphatase Test.

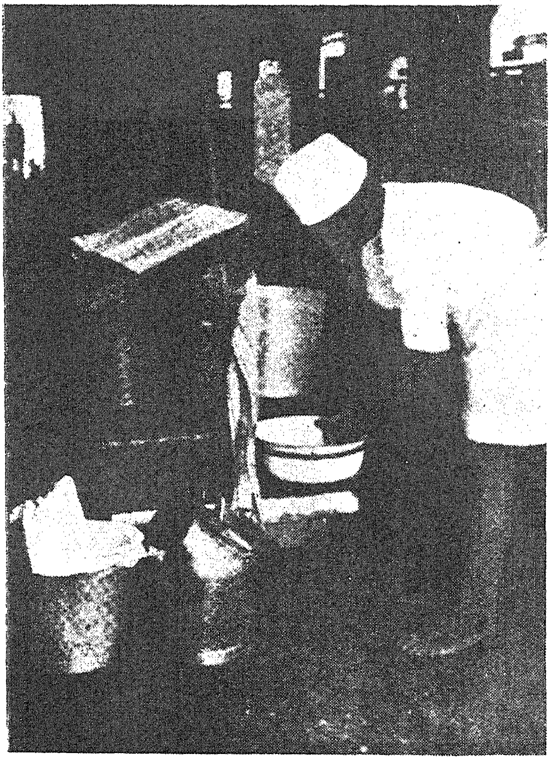
Cream. When sold as cream, must not contain any preservative or colouring matter or any fat or oil other than milk fat. It must contain not less than 35 per cent. of milk fat and be free from the tuberculosis germ. This standard does not apply to cream supplied to a creamery for conversion into butter.

Reduced Cream. Must comply with the above standards, but must contain not less than 20 per cent. of milk fat.

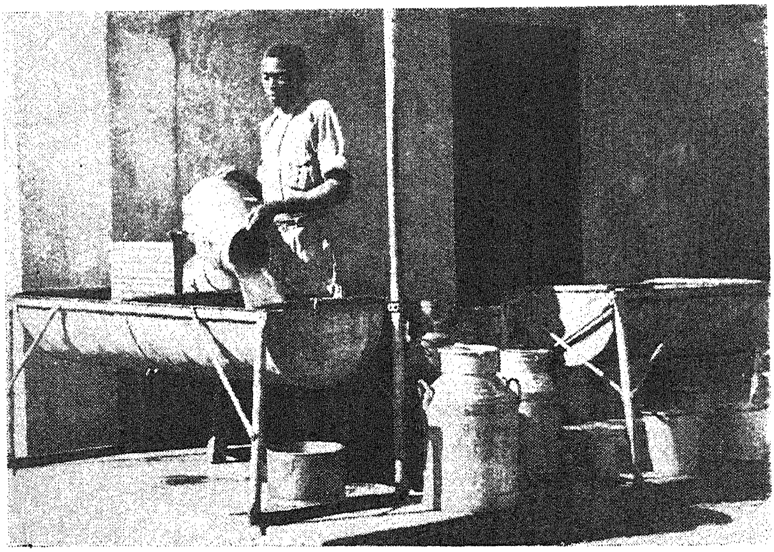
Butter. Butter must contain not less than 80 per cent. of milk fat, not more than 16 per cent. of water and not more than 4 per cent. of salt. It must be free from preservative and contain no mycobacterium tuberculosis.

Cheese. Varieties such as cheddar and gouda cheese must contain not less than 45 per cent. of milk fat in its water-free substance; it must not contain any fat or oil other than milk fat.

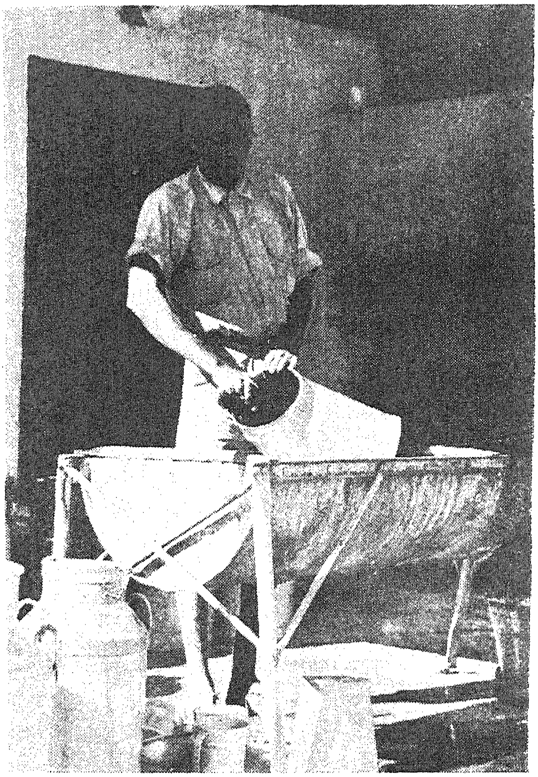
Cream Cheese. Must contain not less than 55 per cent. of milk fat in its water-free substance.



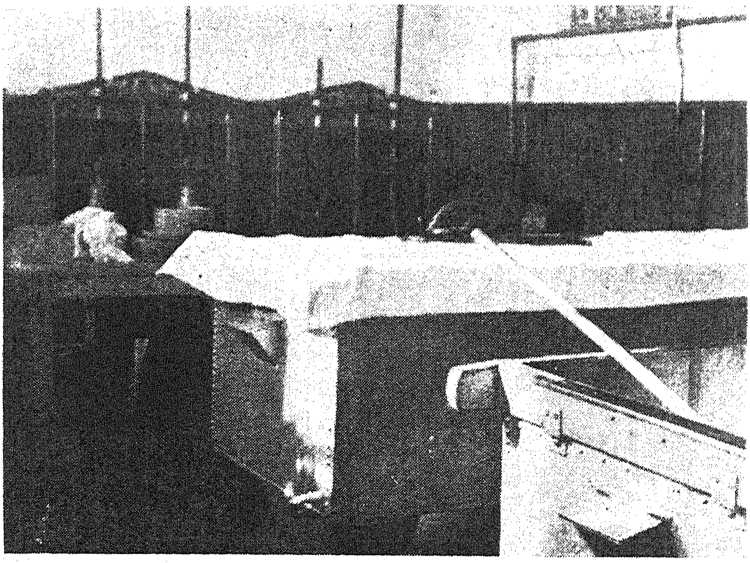
African labour with proper training and supervision can be used in dairying with considerable success. (Washing the hands before milking.)



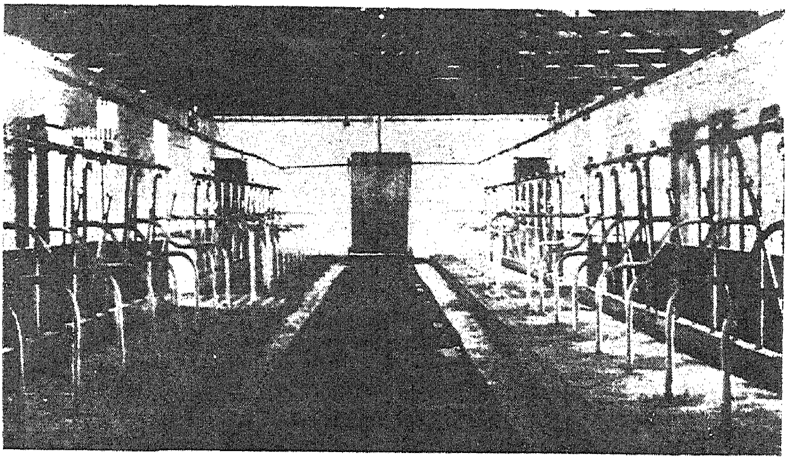
Cleaning the dairy utensils.



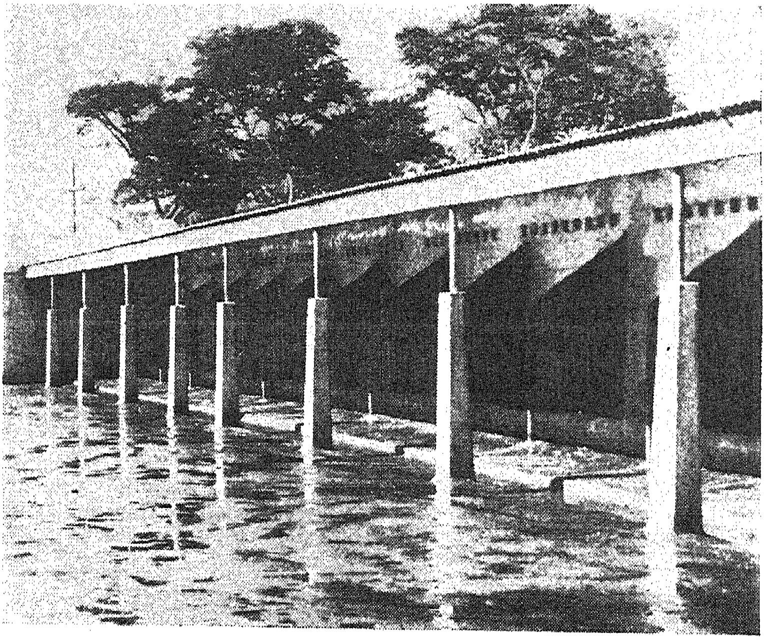
Cleaning the dairy utensils.



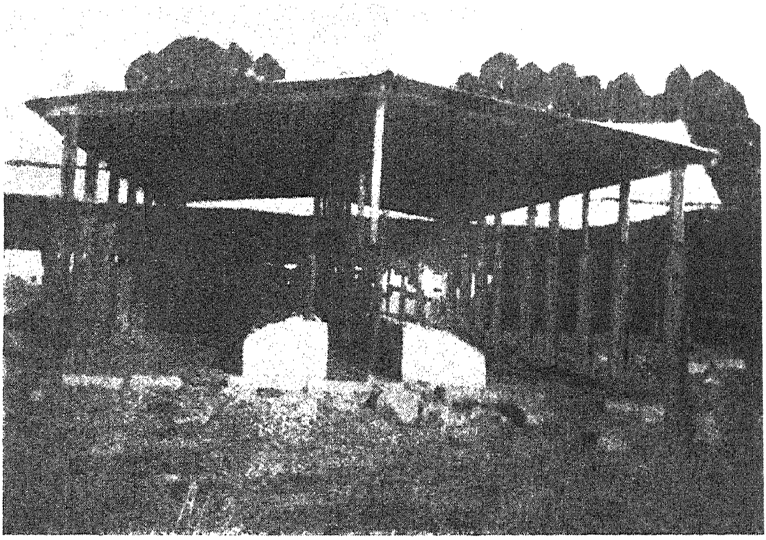
Cheese-making room, Rhodesia Co-op. Milk Company, Bulawayo.



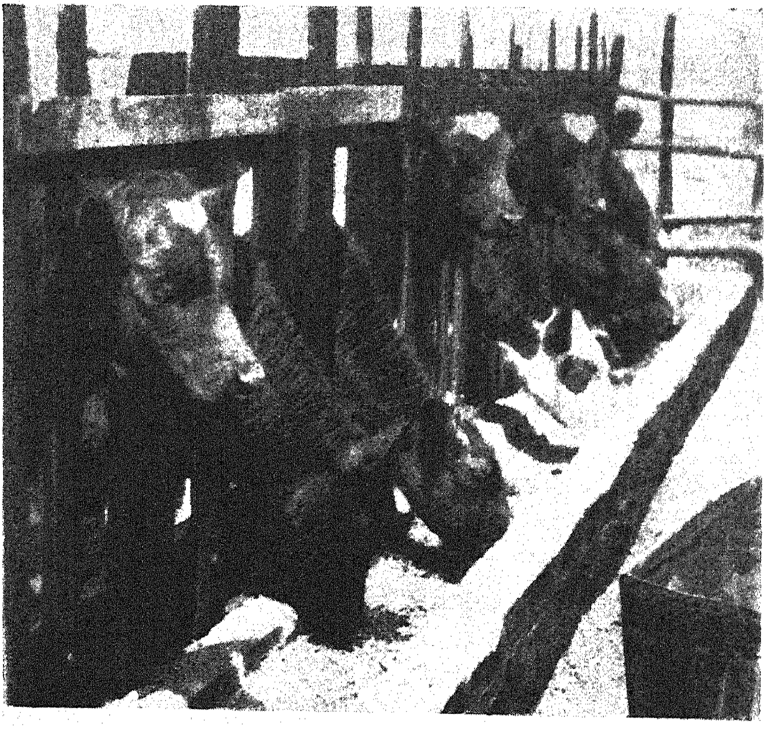
A well-constructed cowshed with modern fittings.



A well-constructed simple type of milking place.



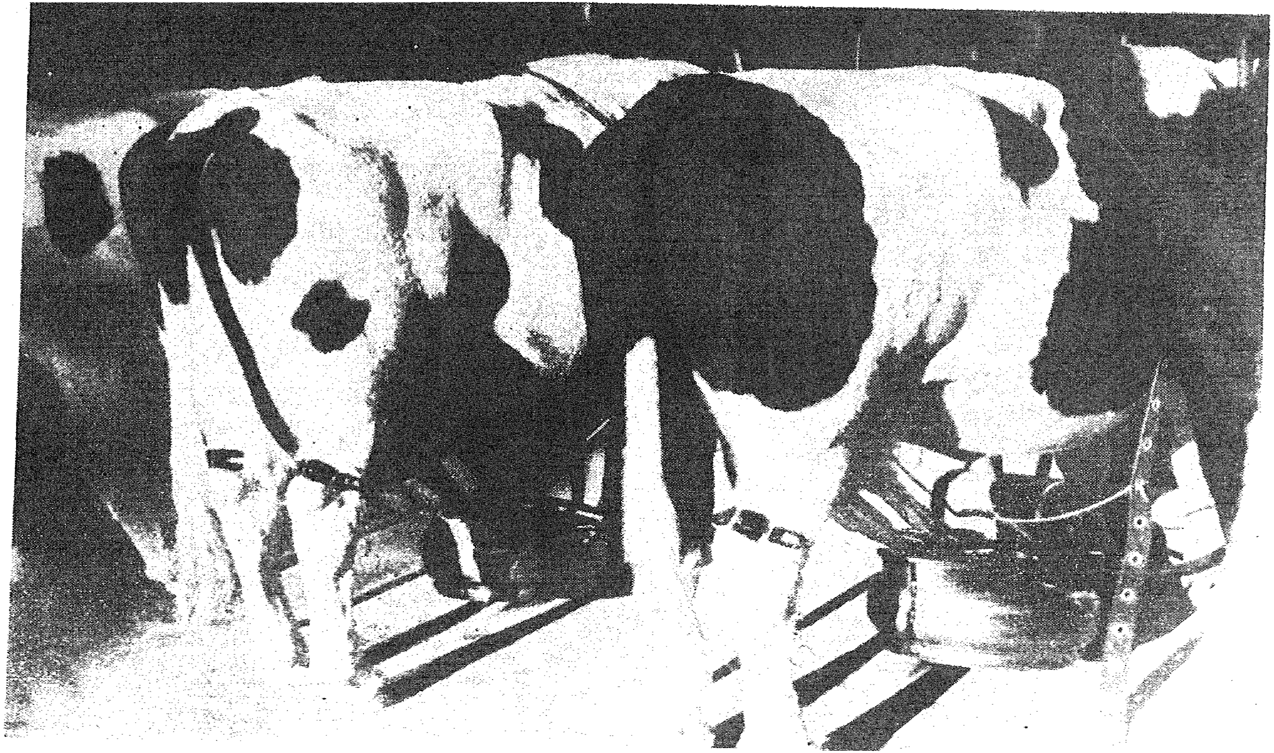
A simple lean-to milking place.



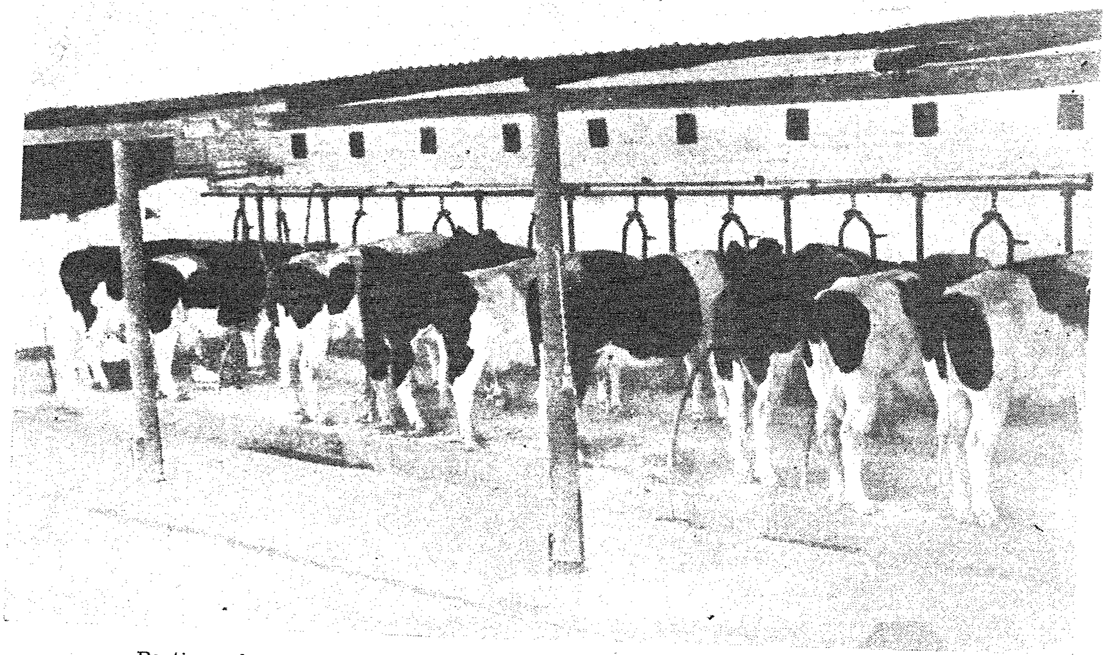
Feeding time for the calves.

A useful lot of hand-reared heifers.

A useful herd of grade cows.



Milking machine (Surge) in operation at Grasslands Experiment Station, Marandellas.



Portion of the Dairy Herd at Grasslands Experiment Station, Marandellas.

HERD AVERAGE, 1945/46.

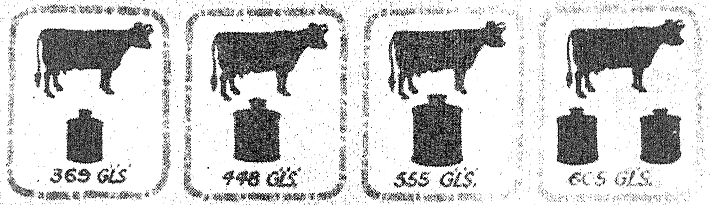
Milk lbs.	*Butterfat lbs.*	*% Butterfat*	*Days*
11,113.0	396.8	3.57	297

MILK RECORDING.

THE AVERAGE MILK PRODUCTION OF TESTED COWS IN THIS COLONY HAS INCREASED BY NEARLY 70 PER CENT IN THE LAST 15 YEARS.

HERE ARE THE FIGURES!

The COWS TESTED UNDER the GOVERNMENT MILK RECORDING SCHEME.



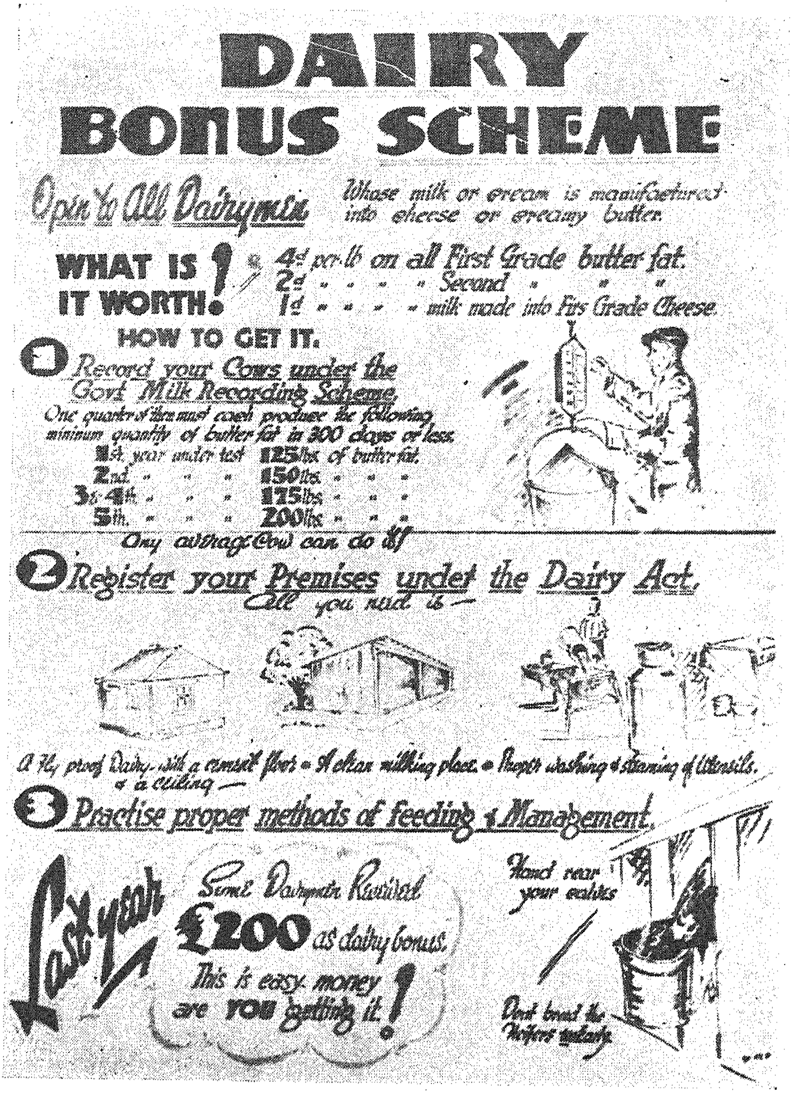
• 1930 • 1935 • 1940 • 1945

• HAS YOUR DAIRY HERD MADE SIMILAR IMPROVEMENT.?

GET THOSE COWS TESTED UNDER THE GOVT. MILK RECORDING SCHEME.

Its cheap enough. Heres the tariff.
10/- For each visit by the Milk Recorder for this you can have 50 cows tested at each visit. For more than 50 cows the charge is £1-0-0

The Better the Cow, The Greater the Profit!



DAIRY BONUS SCHEME
Open to All Dairymen
Whose milk or cream is manufactured into cheese or creamy butter.
WHAT IS IT WORTH!
4d per lb on all First Grade butter fat.
2d " " " " Second " " "
1d " " " " milk made into First Grade Cheese.
HOW TO GET IT.
1 Record your Cows under the Govt Milk Recording Scheme.
One quarter of them must each produce the following minimum quantity of butter fat in 300 days or less.
1st year under test 125lbs of butter fat.
2nd " " " 150lbs " " "
3rd & 4th " " " 175lbs " " "
5th " " " 200lbs " " "
Any average Cow can do it!
2 Register your Premises under the Dairy Act.
All you need is—
A fly proof Dairy with a cement floor & a ceiling — A clean milking place. — Proper washing & steaming of Utensils.
3 Practise proper methods of feeding & Management.
Last year
Some Dairymen Received £200 as dairy bonus.
This is easy money are YOU getting it!
Hand rear your calves
Don't breed the Heifers too early

Skim-Milk Cheese. Must contain not less than 10 per cent. of milk fat.

Ice-Cream. Must contain not less than 10 per cent. of milk fat and 18 per cent. of total milk solids and not more than 0.5 per cent. of stabiliser. Ice-cream containing ripe fruits or nuts, however, must contain not less than 8 per cent. of milk fat and 16 per cent. of total milk solids. It must not contain more than 200,000 organisms per gram.

Dairymen or others who require more detailed information on any of the matters referred to in this article are advised to get into touch with the Chief Dairy Officer, Department of Agriculture, Salisbury.

APPENDIX.

DAIRY BONUS SCHEME.

Under the following scheme, special bonuses are paid on first and second grade butterfat supplied to a creamery and on milk converted into Cheddar, Gouda or Roquefort cheese. The conditions are as follows, viz. :—

The bonuses are as follows:—

First Grade Butterfat	4d. per lb.
Second Grade Butterfat	2d. per lb.
Milk converted into First Grade Cheddar Cheese	1d. per gallon
Milk converted into Gouda Cheese	1d. per gallon
Milk converted into Roquefort Cheese	1d. per gallon

In the case of Gouda and Roquefort cheese which does not require to be graded, the Chief Dairy Officer has to certify that the quality of the cheese manufactured during the year has been such as to merit the bonus.

To qualify for these bonuses, which are payable at the end of each dairying season, viz., at the end of September in each year, a producer must obtain a certificate from the Secretary, Department of Agriculture and Lands, Salisbury, certifying as follows:—

(1) That his herd has been milk recorded under the Southern Rhodesia Milk Recording Scheme.

(2) That 25 per cent. of the cows recorded during the year have each produced a minimum of 125 lbs. of butterfat in 300 days or less. This standard operates for the first year. In the second year this standard is raised to 150 lbs. of butterfat, in the 3rd and 4th years to 175 lbs. and in the 5th and subsequent years to 200 lbs. of butterfat.

(3) That his dairy premises are registered under the Dairy Act.

(4) That his methods of feeding and management have been approved—the main factors here to be the condition of the young stock and the use of an approved bull.

Producers wishing to take advantage of the scheme should get in touch with the Chief Dairy Officer, Department of Agriculture, P.O. Box 387, Salisbury.

Sheep and their Management in Southern Rhodesia.

By R. H. FITT and A. A. MORRISON, Animal Husbandry Officers.

Sheep farming has not made much progress in the Colony. The untamed nature of the veld in many parts and mismanagement due to lack of knowledge, experience and interest have been mainly responsible.

Experience has shown that under present conditions sheep do well when run in small flocks. The most convenient and successful unit seems to be one of about 100 ewes and 2 rams. Such flocks not only supply the farmer with his mutton requirements, but form a valuable side-line on any mixed farm and return a small but very useful income at little expense.

On account of bush and the prevalence of various grass-seeds, such as "Assegai" or "Spear" grass (*Heteropogon contortus*) and the "Stick" grasses (*Aristida* spp.), most of the Colony is unsuited for woolled sheep.

CHOICE OF BREED.

The **Blackhead Persian** (1) has so far proved the most popular choice. Because of its smooth coat, inherent hardiness and natural resistance to tick-borne (heartwater) and other diseases, it has done well in most parts of the Colony. It is a good forager, and during the summer months accumulates large amounts of fat over the rump and in the tail, and this acts as a reserve in times of scarcity. The breed is, therefore, able to subsist on scanty vegetation and survive long periods of drought. The main drawbacks of the Blackhead Persian are its poor mutton conformation and the uneven distribution of the fat in the carcase.

The **Ronderib Africander** breed has been tried by a number of farmers. Rams of this breed have been used on Blackhead Persian ewes with the object of increasing the size of the progeny. So far most of the attempts have failed, and the cross is not recommended.

Dorsian rams, i.e., Dorset Horn x Blackhead Persian "crossbred" rams, have also been used on the Blackhead Persian. This is a very popular cross in the Union of South Africa. The progeny, known as "quarter-breds," because they carry ¼ Dorset Horn and ¾ Blackhead Persian blood, show promise locally, but more experi-

(1) Notes about the origin and breed characteristics of the Blackhead Persian are given at the end of the article.

ence is necessary before a definite opinion can be expressed. The "quarter-breds" are certainly of better conformation and size than the pure Persian and fortunately carry very little wool.

The **Merino** has been in the past the popular choice in the higher lying parts of the Colony, such as Melsetter and Inyanga. Many flocks were commenced 15 to 20 years ago, but to-day only a small number remain. The falling-off has been due largely to the high mortality rate caused by excessive rainfall which affects the sheep's growth and makes control of internal parasites very difficult.

Other breeds more suited to high rainfall, such as the **Corriedale** and **Romney Marsh,** have been tried, but with little better results. The latter produced good cross-bred lambs but could not be induced to breed for Autumn lambs and proved very susceptible to disease and very soon died out.

THE SHEEP FARM.

Experience has shown that areas with medium to low rainfall are best suited to sheep. Farms comprising large, wet vlei areas with little dry ground are unsuitable, as are also those which, though dry in the winter months, become soggy and water-logged during the summer. A well-drained farm free from excessive surface water is the most favourable, and providing the grazing is fairly well tamed, the type of soil makes no material difference.

Water. This is a very important point in flock management. Sheep should always have access to good, clean drinking water. Water from wells or boreholes led into troughs is by far the best. The troughs should be kept clean and should be cleaned out every two or three weeks. Sheep should be kept away from standing water in vleis and dams, as these places are ideal breeding grounds for internal parasites. When sheep have to drink at rivers, pools or dams, they should be driven to water together and taken away directly they have finished drinking. They should under no circumstances be allowed to graze near such places.

Shelter. The non-woolled breeds of sheep require some form of shelter, especially during the rains, and where cold, wet nights are experienced. Nothing elaborate or expensive is required. A good roof with a wall along the weather side is sufficient. It is important that the shelter be large enough to accommodate the flock without crowding. When sheep are crowded together, especially during the rainy season, sweating takes place, and when they are let out to graze they are liable to get a chill and pneumonia may result, with consequent heavy loss. It is far better to yard sheep in an open kraal than to confine them in a shed which will cause crowding. An open lean-to shed with a yard in front has proved very successful. (See illustration.)

Woolled sheep only need protection on cold, wet nights from the wind, and if the weather side of the kraal is protected, this will be sufficient.

Yards. A yarding system is necessary, not only to assist classing and culling, but also dosing. Dosing with the assistance of a race reduces the handling of the sheep to a minimum and makes it quick and easy.

BREEDING STOCK.

In the selection of breeding stock, constitution and size should be given first consideration. Trueness to type can be selected for when numbers increase.

Rams. Always use a pure bred or standard cross-bred ram of good type with a strong constitution. Grade rams or rams of poor quality, showing lack of constitution and development, should never be used.

Ewes. The ewe should also be strong, robust and well developed. Good milking capabilities should be looked for, as this is a big point in the rearing of strong, healthy lambs.

The better type of "native" ewe should not be despised as foundation stock. Using good rams and practising careful selection, a good grade flock can be soon established.

In selecting stock for breeding, always make sure to examine the mouth for over- or under-shot jaws. Sheep having one of these faults are invariably bad doers.

GENERAL MANAGEMENT.

All sheep respond to good management. If good results are to be expected, a careful and intelligent system of management should be followed. Furthermore, in the control of internal parasites, management plays as important a part as dosing.

Grazing of Flocks. The ideal way of grazing sheep is to allow them to graze in paddocks or camps without herding or kraaling. At present this is economically not possible, and the majority of farmers have to use the system of herding by day and kraaling by night. When this is done, it is most important to see that the sheep are sent out to graze as early as possible in the mornings. Sheep prefer to graze in the cooler times of the day and to rest and lie in the shade during the heat of the day.

If a system of paddocks or camps is put into operation, it is very important that there be sufficient of these so as to make rotational grazing possible, and so allow the grazing to be rested periodically. This is not only a most important point in pasture management, but it also assists very much in the control of internal parasites, as pastures grazed continuously become "sheep sick" and heavily infested with internal parasites.

Rams. To obtain the best results from the rams at mating time they should be in a healthy and hard condition, but not over-fat. If good results are to be expected, they should be fed a supplementary ration of about ¼ to ½ lb. of maize per day, plus some bean hay, for 6 to 8 weeks before the breeding season commences.

Rams should not be allowed to run with the ewes day and night. Better results will be obtained if they are kept at home, in some shady spot, during the hotter part of the day, and fed a supplementary ration, to keep up their condition and vigour. If it is not possible to practice this, especially where large flocks are run and the rams show signs of becoming less active, they should be separated from the ewes for three or four days once a fortnight or so and fed a supplementary ration. If large numbers of rams are run, it is often advisable to rest a few of the rams at a time for a few days throughout the mating season.

During the non-breeding season the rams can be kept in a small camp and fed a maintenance ration of maize and bean hay, together with a little succulent feed daily. If only one ram is kept, a hamel (wether) or two can be put with it for company.

Ewes. Before the rams are put to the ewes, all old ewes, those of poor type and other undesirable ones should be culled from the flock and kept separate. These should be fattened and sold for slaughter.

In order to get the best results, the ewes should be in good condition at mating time. They should preferably be in an improving condition at this time, i.e., flushed. This will ensure larger lamb crops.

Lambing Time. Local and seasonal conditions will determine the best time of the year for ewes to lamb.

In the Colony, generally, the most suitable time is considered to be from the 1st March to the end of May, with Matabeleland two weeks to a month earlier than Mashonaland, i.e., roughly from the 1st March to the 30th May for Matabeleland and 15th March to 15th June for Mashonaland. The rams should, therefore, be with the ewes from the beginning of October to the end of December, and 15th of October to 15th of January for Matabeleland and Mashonaland, respectively.

Maiden ewes should not be bred until they are full two tooth, i.e., about 18 months old, and then only if they are sufficiently well developed. Ewes should be allowed to lamb only once a year. Lambing twice a year is much too hard on ewes under our conditions.

Lambing. Shortly before lambing, all ewes heavy in lamb should be removed from the rest of the flock and run separately until they have lambed and the lambs have been weaned. Under this system the youngsters do very much better.

The better grazing should be reserved for the ewes and lambs, and as much green grazing or other succulents as possible should be provided for the lambing season. A stack of legume hay, some pumpkins and majordas will be a considerable value at this time. It will ensure that the ewes have lots of milk, which is essential for good growth in the lambs. Grazing on legume stubble or reaped maize lands is also very useful for this purpose.

During lambing time supervision must be increased, and a personal inspection of the flock should be made at least twice daily to ensure that ewes in need of assistance get it.

A ewe having difficulty in lambing should be assisted as soon as possible. In the case of weak lambs, it is often necessary to hold the ewe and then tempt the lamb to drink. Often maiden ewes are disinclined to take their lambs. In such cases the ewe should be held while the lamb drinks. As a rule it will only be necessary to do this three or four times. Sometimes it may be necessary to shut the ewe with her lamb in a small pen for a day or two.

Older ewes that are troublesome in this respect should be marked and sold sold after their lambs are weaned. Ewes not having an ample supply of milk should also be sold.

Castration. Ram lambs not intended for breeding purposes should be castrated when two to four weeks old, and not allowed to run until six to eight months. For castrating, the burdizzo pinchers give good results, if properly used, but it is always advisable to go through the lambs again a month or so later in case a few were missed or were not properly done. In areas where screw worm is not troublesome the ordinary knife may be used, and is, in fact, preferable. Always use a clean, sharp knife and do not work in dirty kraals.

It is not necessary to dock the tails of the Blackhead Persian and its grades. In the case of the Merino and other woolled breeds, this should be done. The usual procedure adopted is to dock the tails of ewe lambs at the first joint from the head of the tail, and of hamel lambs at the third or fourth joint. This is done very largely in order to make the distinguishing of the sexes easy when sorting out takes place.

Marking. For easy identification a system of ear-marking is used. This is usually done with a sharp knife or clippers. The system usually adopted is to have a distinctive ear mark and to mark the lambs in a different place on the ear each year. This enables the farmer to tell the age of the sheep at a glance.

Another system often used is to brand the sheep with a marking fluid, especially made for the purpose. Ordinary branding irons, or thick wire bent to the desired letter or mark, are used.

Weaning. The age at which to wean will depend largely on the season and the development of the lambs. As a general rule five months is the most satisfactory age.

When weaned, care should be taken to see that the lambs do not receive a set-back. They should be put on to good grazing, if available, and fed supplements, such as legume hay, maize, etc., if necessary.

Once lambs receive a set-back they *never* recover from it. It is essential, therefore, to keep them growing.

After weaning, it is advisable to run a few wethers or dry ewes with the lambs. This will assist them to settle down.

Fattening Sheep. On the mixed farm this should not present any great difficulty, or be an expensive matter, as there is generally a good supply of suitable feeds.

Wethers should be sold as six to nine months old lambs, and definitely before they have cut their first two incosors. Good prices are paid for young sheep in good condition.

The following is a good fattening ration when grazing is of low feeding value, such as during the winter months:—

Concentrates (maize)	½-1 lb. per sheep per day
Legume hay (bean hay, etc.)	1½ lb. per sheep per day
Succulent feed (silage, pumpkins, etc.)	2 lb. per sheep per day

Where sheep are entirely pen-fed they should be given as much good quality veld hay as they will eat, in addition to the above ration. A good supply of clean drinking water should always be available.

Fat Lambs. By this is meant lambs to be marketed at four to five months old, and dressing out between 25 and 30 lbs. To reach this standard it is necessary to breed from good, strong, roomy ewes with lots of milk. They must be in good condition at lambing and not allowed to get thin. It is most important that the lambs be kept growing rapidly without a check until the desired weight is reached. This can only be achieved if both ewes and lambs are well fed.

Marketing. The fairest way to sell sheep is by weight, either live weight or dressed weight. This will ensure that the producer gets full value for his product.

With March to May lambing, most of the lambs should be ready for marketing from November to January if they have received good treatment and some supplementary feeding before and after weaning.

When selling sheep, always show the sheep to the buyer in as good and attractive appearance as possible.

Licks. A mineral lick is generally recommended for sheep in the Colony. Such licks appear to be more essential in the heavier rainfall areas than in the drier sections. A mixture of three parts of bonemeal and one part of salt, by weight, has proved successful.

INTERNAL PARASITES.

These present probably the greatest difficulty in the successful running of sheep in the Colony, and their proper control is therefore of considerable importance. This is possible by:—

(a) Regular and systematic dosing. Full particulars can be obtained from the Veterinary Department.

(b) Not allowing sheep to graze near vleis, dams or other moist places.

(c) Rotating the grazing and not running sheep on the same part of the farm year after year.

(d) Keeping the sheep in good condition by means of supplementary feeding when necessary.

How to Determine the Approximate Age of Sheep. The usual method of telling the age of a sheep is by its teeth. This method is not exact, but is quite satisfactory for practical purposes.

The temporary or lamb's teeth are small and are eventually replaced by permanent ones, which are much larger. The animal's age is estimated by counting the number of pairs of the secondary incisors.

No. of Teeth	Age of Sheep
2 secondary incisors—Two tooth	14 to 16 months
4 secondary incisors—Four tooth	2 years
6 secondary incisors—Six tooth	3 years
8 secondary incisors—Full mouth	4 years

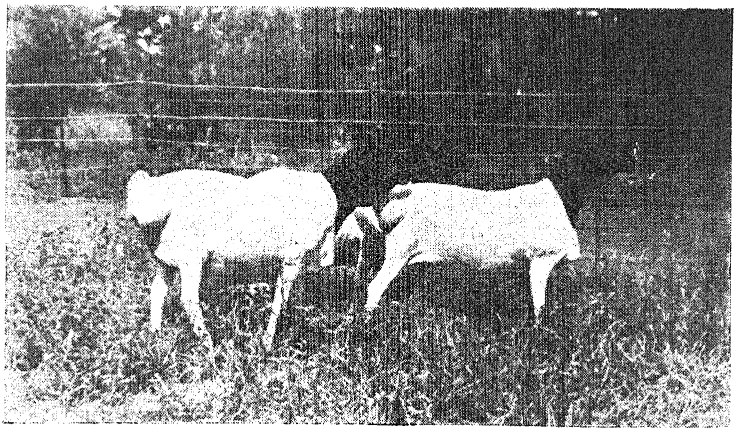
After this stage, age is determined, firstly, by the length of the incisors and later by the degree to which they are worn down.

THE BLACKHEAD PERSIAN.

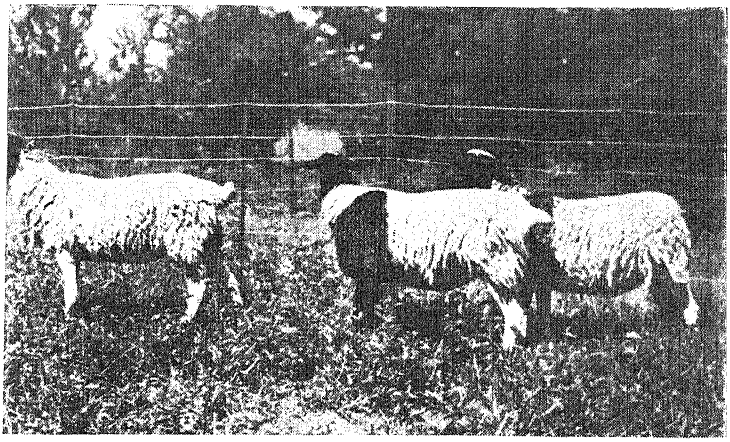
ORIGIN AND BREED CHARACTERISTICS.

Origin. Whereas the ordinary "Native" sheep and the fat tailed Africander sheep are indigenous to South Africa, the Blackhead Persian is not. It belongs to the fat-rumped sheep of Asia and North Africa, and particularly to that group found in Arabia and Somaliland.

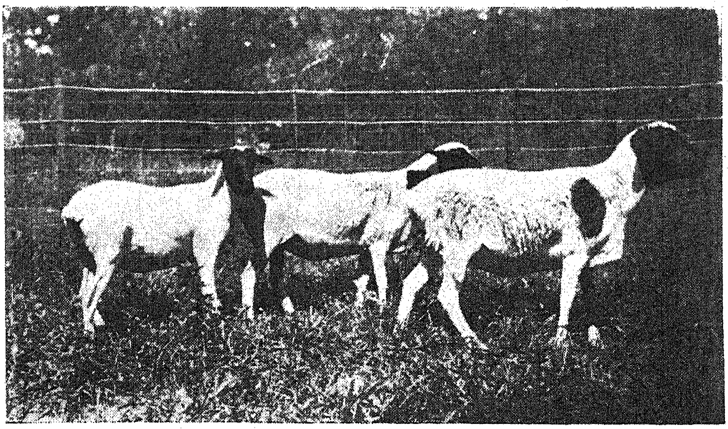
The late Mr. Montague Gadd, who was the oldest breeder of Blackhead Persians in South Africa, described the early introduction of the breed as follows: "About the year 1865 a disabled sailing vessel put into Port Beaufort, a bay on the Swellendam Coast. The late Messrs. Barry and Heatlie happened to visit the boat, and, being farmers, were interested in three blackhead ewes which had been loaded at Aden, in the Persian Gulf, as butcher's stock for the use of the crew. They managed to secure the three ewes in exchange for other suitable slaughter sheep and sent them round to Cape Town and from there to Worcester, the railhead in those days, and from there by ox-wagon to their farm Glen Heatlie in the Robertson district. Two of the three ewes were fortunately in lamb and one lambed twin ewe lambs



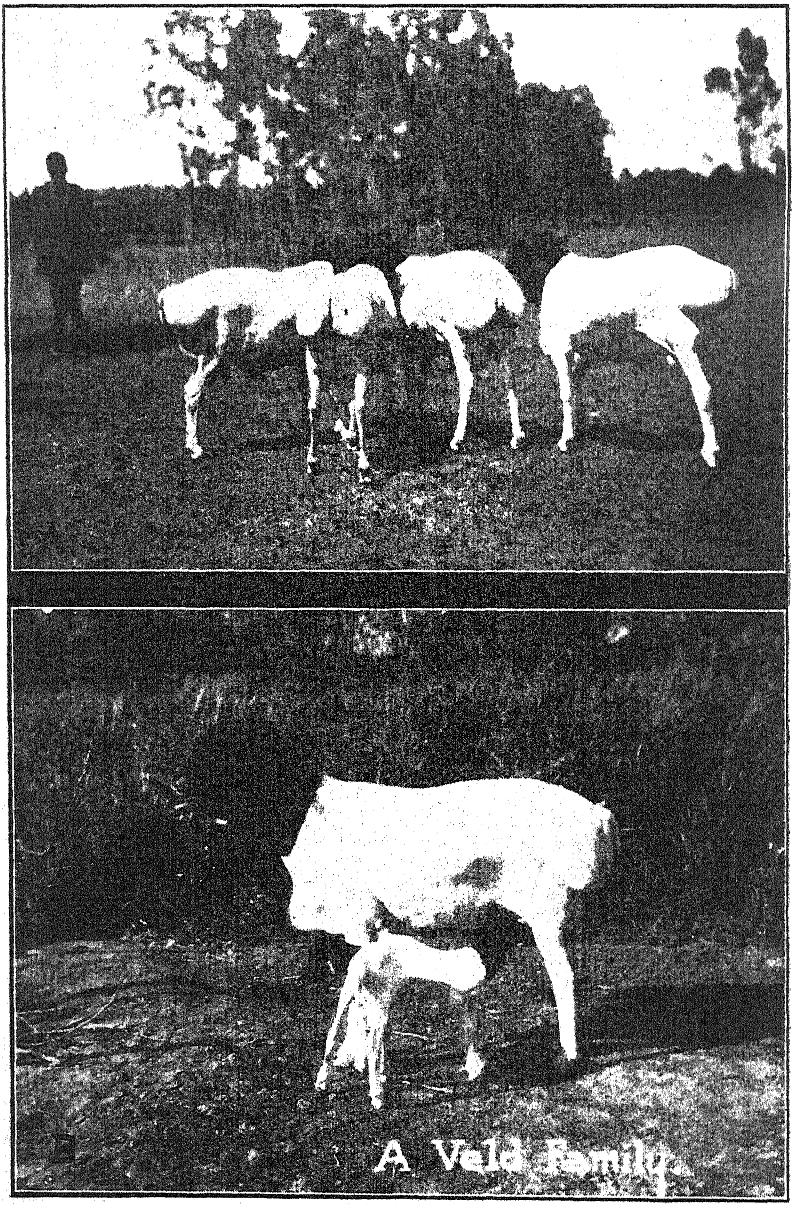
Good type Blackhead Persian flock ewes.



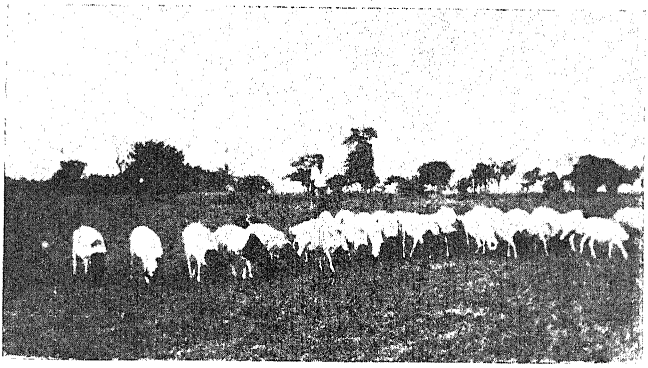
"Cross-bred" ewes, the progeny of Dorset Horn rams on good Blackhead Persian ewes. Note good mutton conformation but woolly coat.



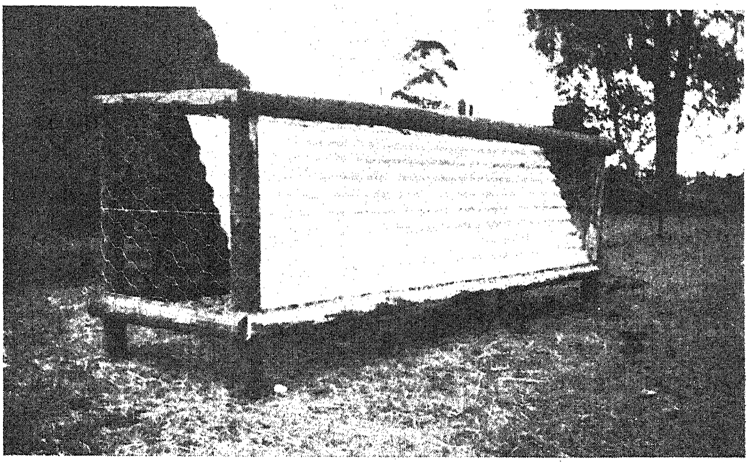
"Quarter-bred" ewes, the progeny of half-bred rams (Dorset Horn x Blackhead Persian) and good Blackhead Persian ewes. Of better mutton conformation than the pure Blackhead Persian.



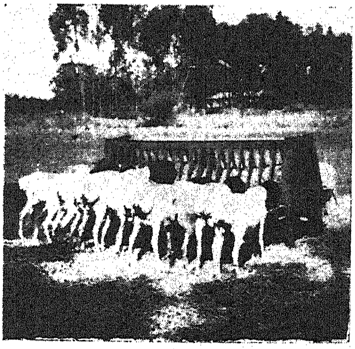
A. Rams suitable for grading up.
B. Twins.



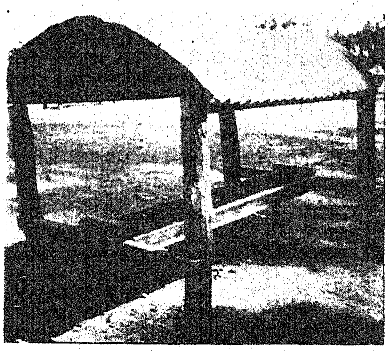
Grade Persian lambs on a Matabeleland farm.



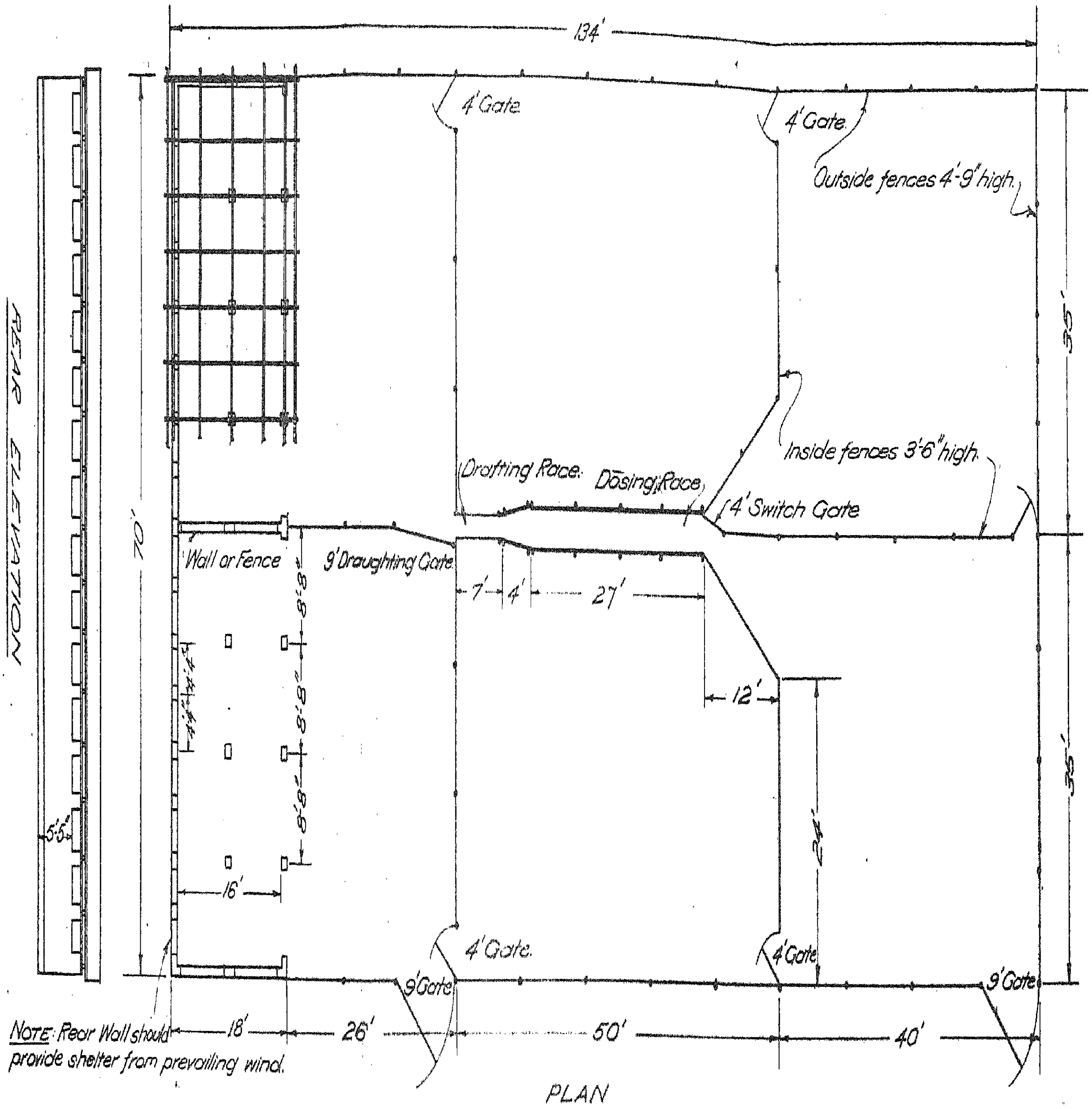
A useful rack for feeding hay to sheep. The leaves and seeds do not get into the wool when the sheep feeds, as is the case with the ordinary overhead rack.



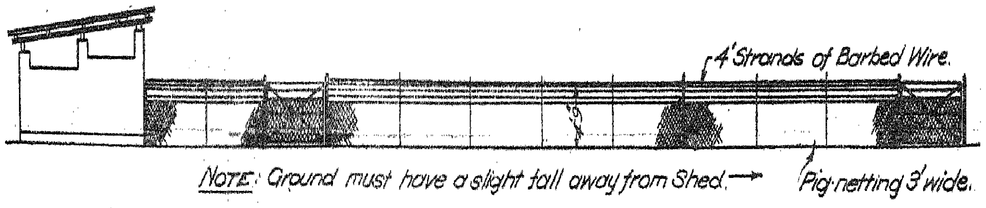
The extra supplementary ration during winter months.



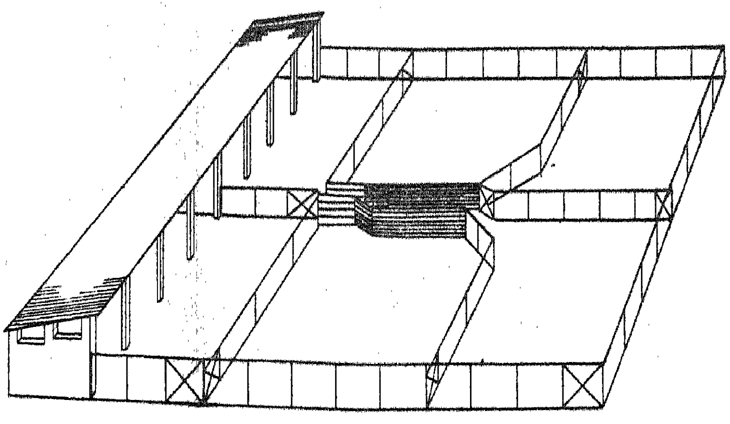
A trough for feeding a mineral lick to sheep. Note the roof to protect the trough in the wet season.



PLAN



SIDE ELEVATION



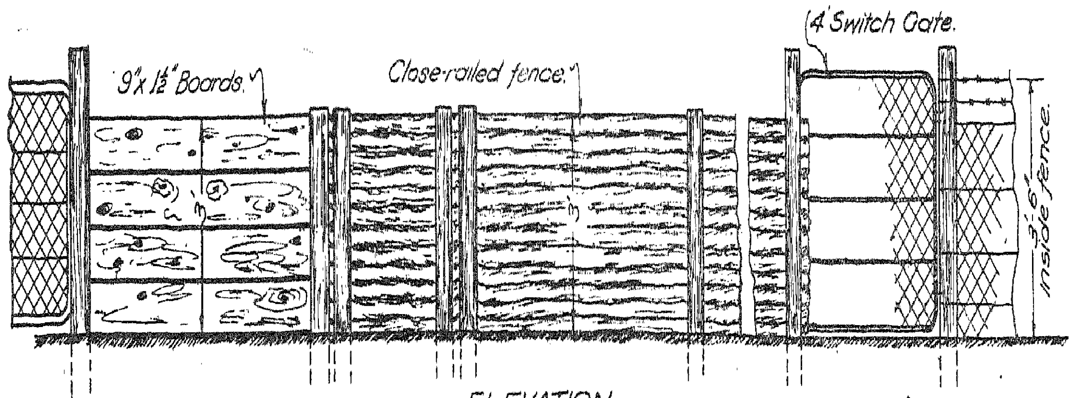
PERSPECTIVE VIEW OF SHED AND YARD.

SHEEP SHED AND YARD—GENERAL VIEWS.

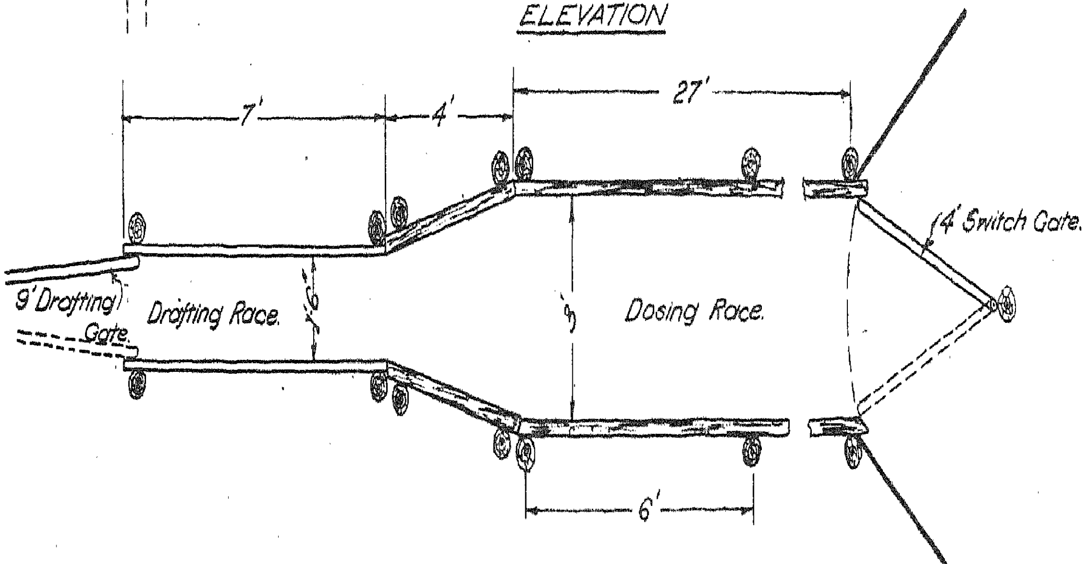
IRRIGATION DEPT. 20.6.1947.

For Details see Plate II.

Plate I

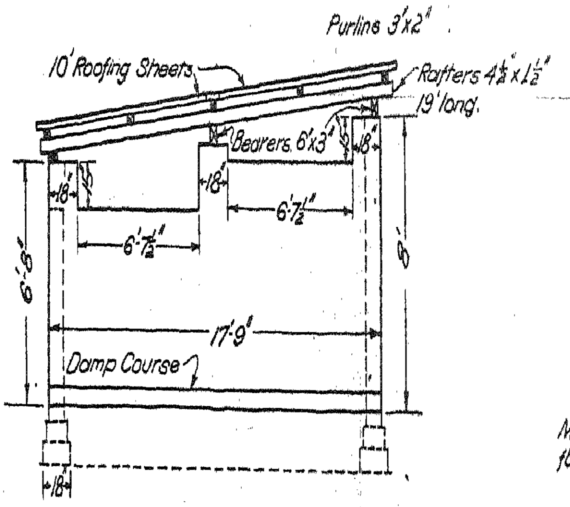


ELEVATION



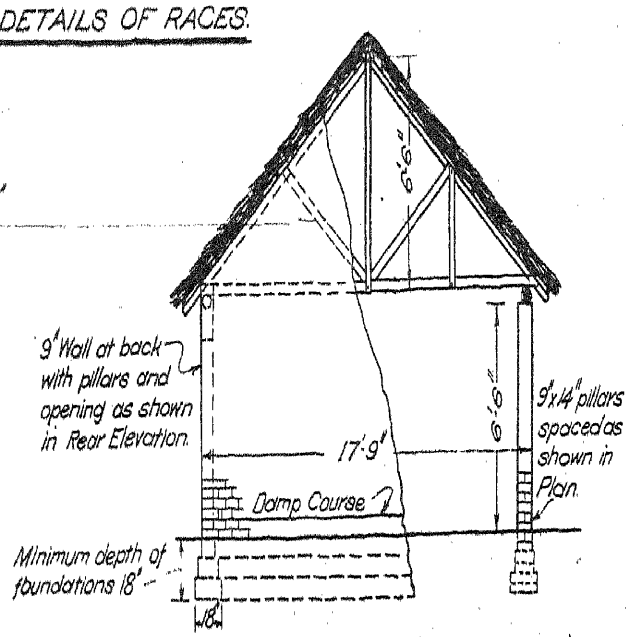
PLAN

DETAILS OF RACES.



END WALL

Showing details of roofing with corrugated iron or asbestos. Bearers and rafters may be of straight poles, but purlins should be of sawn timber



END WALL (Part Section)

Showing alternative thatched roof.

Foundations and Walls may be of burnt-brick or stone. The foundations must be laid in lime or cement mortar. The walls may be laid in lime mortar or in dagga and pointed with cement.

SHEEP SHED AND YARD — DETAILS.

IRRIGATION DEPT. 20: 6: 1947.

For General Views see Plate I

PLATE II

Good type Blackhead Persian rams.

and the other a ram lamb. From this lucky venture most of the Blackhead Persians in South Africa to-day have sprung."

In 1895 Mr. Gadd secured Mr. Heatlie's entire flock, who had by then acquired Mr. Barry's share.

Mr. Gadd further stated: "In about 1903 an importation was made by a Mr. Barry, but they were very inferior to the animals we had then bred in the country. In competition with locally bred sheep at a Port Elizabeth Show shortly after the Boer War not one secured a prize."

"A few years ago a Blackhead Persian enthusiast wrote to agents for a photograph of the best Persian sheep procurable with a view to importing some with the object of introducing fresh blood into his flock, but the result was very disappointing. The photograph taken of two sheep standing on a beautiful Persian carpet, was of two wretched animals, not to be compared with the South African Blackhead Persian of to-day."

The Blackhead Persian is recognised as a pure breed of sheep, and since 1906 registrations have been effected in the South African Stud Book.

As regards the distribution of the breed, Blackhead Persians of South African origin are to-day found in large numbers in the British West Indies, Kenya, Tanganyika, Belgian Congo, Portuguese East Africa, Northern Rhodesia, Southern Rhodesia, Bechuanaland, South-West Africa and the Union of South Africa.

BREED CHARACTERISTICS.

Standard of Excellence. The following is the official standard of excellence and scale of points of the breed:—

		Maximum Points
1.	*Head and Neck*—to be of black colour, with black running evenly round the neck, black to extend no further than the neck, bag under neck well developed, large and hanging	10
2.	*Tail*—well-defined, well up to the back, full, firm and square, and not hanging sloping downwards. The second joint not too large nor coarse, to be firmly set against the main tail in a backward position, the small joint being on a level with the back. The third joint to hang perpendicularly and not too coarse. Tail to hang true, i.e., not on one side	20
3.	*Symmetry*—back broad, deep at girth, good brisket, short, straight legs	30
4.	*Weight and Size*	30
5.	*Coat*—strong, smooth and without wool	10
		100

Disqualifications. White spot on head, horns, wool or black on body, visible white spots on black skin of tail; grey colouring on the tail or legs of a two tooth sheep (a few grey hairs on the tail or legs of a four tooth or older sheep need not necessarily disqualify.)

General Description. Professor Duerden, of the Rhodes University College, Grahamstown, who made a close study of the breed, described it as follows:—

"The *body* is compact in form, combined with good depth, the length being accentuated by the brisket in front and the cushions of fat behind.

"The *head* is short and medium in size. The crown is raised and polled, while the *eyes* are large, bright and prominent, and golden yellow in colour. The *nose* is moderately Roman, and on either side are swellings of fat, as also behind the ears. The *nostrils* are large and wide and the mouth well shaped, an over-hanging lower jaw being avoided. *Horns* are never developed, but between the eyes and ears are sunken hollows in the places they usually occupy. The *ears* are moderately long, thick, leaf-like and tapering. They are actively carried and usually held horizontally, although moving freely forwards, backwards and downwards, flexibility being a marked feature. Unlike the rest of the coat, the ears are smooth and silky to the touch, covered only with fine short hair.

"The *neck* is thick and well set with heavy muscles, the skin showing a slight tendency to wrinkle. The *dewlap* extends from just behind the chin to about half-way down the neck, and in the rams bears a mane of long fine fibres. It is variable as regards its length and depth, and in well-fed sheep is heavy with fat.

"The *chest* is broad and deep and the shoulders wide apart, allowing for full development of the vital organs. The *brisket* is remarkably well developed. As seen from the side it gives a square effect, being vertical in front and horizontal below for some distance, extending well in front of the fore legs. Viewed from the front it is very broad, nearly filling up the space between the legs, the thickness being largely due to a deposit of firm fat.

"The *shoulders* fit neatly against the body without any bony projections. The withers merge insensibly into the shoulder tops, and are approximately level with the hips, presenting a smooth firm surface.

"The *ribs* are well sprung from the back, curving round evenly and projecting somewhat beyond the fore and hind quarters. They are smoothly covered with flesh and only discernible on handling.

"The *loins* are moderately broad in well-bred animals, and the outline of the back is straight. When unimproved the back is curved showing a marked depression in the middle. The *hips* are slightly raised and rounded, although the actual bones are not prominent.

"The *rump* is broad and well developed, and the muscles are covered by the thick pad of fat extending from the tail.

"The *buttocks* are well developed and very prominent, since they are covered by thick pads of fat, which hang below the tail and are firmly applied to the thighs, joining the two for some distance.

"The *hocks* are strong, and when viewed behind are straight and squarely placed, showing good width between the legs. In badly bred animals the hocks are often close together, the animal being said to have cow hocks. This is undesirable, since the sheep cannot walk so easily, nor cover so readily the long distances sometimes necessary for grazing. The joints are strong, but do not project in an unsightly manner.

"The four *legs* come off the body squarely. In comparison with the Merino they seem longer and thinner, the appearance being due to some extent to the absence of wool. The hoof is always black, being deep and of a neat appearance, with no tendency to spread.

"The *rump* and *tail* are distinctive features of the Blackhead Persian. The appearances are at first difficult to interpret, and call for detailed description. The tail is separated into three distinctive parts, known to the breeder as the first, the second and third tails, or first, second and third joints. The first two are mainly swollen masses of fat, and conceal the tail proper, while the third is short and slender like the tail of animals generally. The second tail is curved upwards and forwards and rests upon the first, while the third is drooping and rests upon the second."

Departmental Bulletins.

Copies of these Bulletins may be obtained from the Editor, Box 387, Salisbury. They are issued to residents of Southern Rhodesia at a charge of 3d. per copy and at 6d. per copy outside the Colony.

N.B.—The date the article appeared in the Journal is indicated in abbreviated form before the number, e.g., 10/28 No. 710, means that Bulletin 710 appeared in the Journal for October, 1928.

AGRICULTURE AND CROPS.

10/28.	No 710.	Monthly Reminders for the Farming Year, by the Division of the Chief Agriculturist.
3/29.	No. 727.	Farmyard Manure, by A. P. Taylor, M.A., B.Sc., Agricultural Chemist.
3/31.	No. 815.	New Strains of Oats for Southern Rhodesia, by H. C. Arnold, Manager, Agricultural Experiment Station, Salisbury.
5/31.	No. 822.	Re-stacking of Maize rejected for Export on account of Excessive Moisture.
8/32.	No 859.	Twenty-one Years of Plant Introduction, by Major Mundy, Chief Division of Plant Industry.
2/33.	No 878.	A.I.V. Silage: Memorandum prepared and circulated by Imperial Bureau of Animal Nutrition.
11/35.	No. 972.	Notes on Witchweed, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.
3/36.	No. 982.	Weeds: Control of Weeds on Footpaths and Tennis Courts, by S. D. Timson, M.C., Assistant Agriculturist.
6/36.	No. 992.	Annual Report of the Agriculturist for the year 1935, by D. E. McLoughlin, Agriculturist.
8/36.	No. 997.	Reward Wheat: Report on the Baking Properties and Chemical Analyses, by The Rhodesian Milling and Manufacturing Co., Ltd.
11/36.	No. 1008.	Witchweed, by S. D. Timson, M.C., Assistant Agriculturist.
2/37.	No. 1016.	Natural Protection from Soil Erosion, by S. D. Timson, M.C., Assistant Agriculturist.
4/37.	No. 1022.	Smut Diseases of Wheat in Southern Rhodesia, by G. M. Wickens, B.Sc. (Agric.), Ph.D., D.I.C., Plant Pathologist, Tobacco Research Station, Trelawney.
11/38.	No. 1089.	Witchweed and the Labour Shortage, by S. D. Timson, M.C., Assistant Agriculturist.
5/40.	No. 1153.	Field Selection of Seed Maize, by Alan Rattray, Junior Agriculturist.

5/41. No. 1173 Agricultural Experiment Station, Salisbury: Annual Report of Experiments, Season 1939-40, by H. C. Arnold, Manager.

7/41. No. 1176. Costings of Farm Operations on the Witchweed Demonstration Farm, Auchendinny, Season 1939-40, by S. D. Timson, Asst. Agriculturist, and G. L. Black, Dip. Agric. (Durham), Manager.

11-12/42. No. 1221. A Description of the more common Rhodesian Wheat Varieties, by T. K. Sansom, B.Sc., Plant Breeder.

3-4/43. No. 1230. Costings of Farm Operations on the Witchweed Demonstration Farm, Auchendinny, Season 1941-42, by S. D. Timson, M.C., Agriculturist; G. L. Black, Dip. Agric. (Durham), Manager.

9-10/43. No. 1242. Pyrethrum, by H. C. Arnold, Manager, Agricultural Experiment Station.

5-6/44. No. 1263. Apply Borax to Improve Quality of Sweet Potatoes, by L. G. Willis, in Charge, Soil Research Laboratory (with Carolina State College Agricultural Experiment Station, 1943).

5-6/44. No. 1265. Notes on Growing Sweet Potatoes, by the Agricultural Branch.

9-10/44. No. 1271. Pyrethrum Drying, by V. A. Beckly, M.C., M.A., A.I.C., and F. McNaughtan, B.Sc. (Hons.), Dept. of Agriculture, Kenya.

9-10/44. No. 1275. The Care of Lucerne Lands in Winter, by W. van der Merwe, Field Husbandry Research Officer, Vaal-Hartz Experiment Station.

1-2/45. No. 1285. Wheat—Varieties tested at the Plant Breeding Station, Salisbury, and Available for Distribution, by T. K. Sansom, B.Sc., Plant Breeder.

1-2/45. No. 1297. Sunn Hemp Fibre Production, by D. H. Fox, Fibre Supervisor, Department of Supply, Salisbury.

5-6/45. No. 1305. Wheat Production in Southern Rhodesia, by D. E. McLoughlin, Acting Chief Agriculturist, and T. K. Sansom, B.Sc., Plant Breeder.

7-8/45. No. 1310. Trap Cropping to Control Witchweed, by S. D. Timson, M.C., Agriculturist.

9-10/45. No. 1314. The Ground Nut, by S. D. Timson, M.C., Agriculturist.

9-10/45. No. 1317. Wheat: Examination of the 1944 Southern Rhodesia Crop, by P. Fuller, Chemist, The Rhodesia Milling & Manufacturing Co., Ltd., Bulawayo.

11-12/45. No. 1332. Wheat: Varieties Tested at the Plant Breeding Station, Salisbury, by T. K. Sansom, B.Sc., Plant Breeder.

1-2/46. No. 1337. Green Manuring: When to Plough Down the Crop, by S. D. Timson, M.C., Agriculturist.

3-4/46. No. 1341. The Potato: Methods of Cultivation in Southern Rhodesia, by S. D. Timson, M.C., Agriculturist.

7-8/46. No. 1356. Wheat: An Examination of the 1945 S.R. Crop, by P. Fuller, Chemist, The Rhodesian Milling & Manufacturing Co., Ltd., Bulawayo.

3-4/47. No. 1387. Wheat: An Examination of the 1946 S.R. Crop, by P. Fuller, Chemist, The Rhodesian Milling & Manufacturing Co., Ltd., Bulawayo.

7-8/47. No. 1398. Garden Compost, by S. D. Timson, M.C., Agriculturist.

ANNUAL REPORTS AND REPORTS ON CROP EXPERIMENTS.

7/27. No. 649. Annual Report of Experiments, 1925-26, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Manager.

4/28. No. 683. Annual Report of Experiments, 1926-27, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Station Manager.

7/29. No. 745. Salisbury Agricultural Experiment Station Annual Report, 1927-28, by H. C. Arnold.

7/30. No. 789. Agricultural Experiment Station, Salisbury. Annual Report of Experiments, 1928-29, by H. C. Arnold.

9/31. No. 830. Salisbury Agricultural Experiment Station, Annual Report, 1929-30, by H. C. Arnold, Manager.

10/32. No. 864. Annual Report, 1930-31: Agricultural Experiment Station, by H. C. Arnold, Station Manager.

6/33. No. 895. Salisbury Agricultural Experiment Station Annual Report, 1931-32, by H. C. Arnold, Manager.

3/34. No. 914. Gwelo Municipal Demonstration Station: Final Report, 1933, by S. D. Timson, M.C., Dip.Agric (Wye), Assistant Agriculturist.

9/35. No 965. Salisbury Agricultural Experiment Station Annual Report, 1933-34, by H. C. Arnold, Manager.

2/36. No. 976. Annual Report of the Agriculturist for the year 1934, by D. E. McLoughlin, Agriculturist.

6/36. No. 992. Annual Report of the Agriculturist for the year 1935, by D. E. McLoughlin, Agriculturist.

5/39. No. 1110. The Management and Utilisation of Natural Pastures, by H. C. Arnold, Manager, Salisbury Experiment Station.

4/40. No. 1149. Salisbury Agricultural Experiment Station: Agriculturist's Annual Report on Experiments, Season 1938-1939, by H. C. Arnold, Manager.

5/41. No. 1173. Agricultural Experiment Station, Salisbury: Annual Report of Experiments, Season 1939-40, by H. C. Arnold, Manager.

3-4/42. No. 1200. Witchweed Demonstration Farm. Costings, 1940-41, by S. D. Timson, M.C., Assistant Agriculturist, and G. L. Black, Manager.

5/42. No. 1204. Agricultural Experiment Station, Salisbury: Annual Report of Experiments, Season 1940-41, by H. C. Arnold, Manager.

7-8/43. No. 1237. Annual Report of Experiments, Season 1941/42, by H. C. Arnold, Manager, Agricultural Experiment Station.

7-8/44. No. 1268. Annual Report of Experiments, Season 1942/43, by H. C. Arnold, M.B.E., Manager, Agricultural Experiment Station, Salisbury.

3-4/45. No. 1301. Annual Report of Experiments, Season 1943/44, by H. C. Arnold, M.B.E., Manager, Agricultural Experiment Station, Salisbury.

9-10/45. No. 1319. Witchweed Demonstration Farm. Final Progress Report: December, 1944, by S. D. Timson, M.C., Agriculturist.

7-8/46. No. 1360. Annual Report of Agricultural Experiment Station, Salisbury, Season 1944-45, by H. C. Arnold, M.B.E., Manager, Agricultural Experiment Station, Salisbury.

11-12/46. No. 1378. Annual Report of the Chief Agriculturist, 1945, by D. E. McLoughlin, Chief Agriculturist.

7-8/47. No. 1399. Annual Report of Agricultural Experiment Station, Salisbury, Season 1945-46, by H. C. Arnold, M.B.E., Manager, Agricultural Experiment Station, Salisbury.

AGRICULTURAL BUILDINGS.

9-10/42. No. 1216. Grain Storage Bins, contributed by the Irrigation Dept.

5-6/45. No. 1306. The "Gundry" Tobacco Furnace, by B. G. Gundry, A.I.Mech.E.

11-12/45. No. 1326. Construction of Dipping Tanks, by B. G. Gundry, A.I.Mech.E., and Notes on their Management, by J. M. Sinclair, M.R.C.V.S., Chief Veterinary Surgeon.

11-12/45. No. 1329. A Cheap Portable Colony House for Poultry, by G. H. Cooper, Assistant Poultry Officer.

1-2/46. No. 1334. Piggeries, by B. G. Gundry, A.I.Mech.E., and A. E. Romyn, Ph.D.

3-4/47. No. 1389. Reinforced Brick Grain Bins, by Grain Bag Shortage Committee.

CHEMISTRY.

4/32. No. 852. Mixing of Fertilisers: A Guide to Methods of Calculation, by the Division of Chemistry.

1/34. No. 910. The Toxicity to Grazing of Grass Sprayed with a Solution of Sodium Arsenite, by A. D. Husband, F.I.C., and J. F. Duguid, M.A., B.Sc.

5/35. No. 954. Experiments on the Toxicity to Fowls of Arsenite of Soda and Poisoned Locusts, by J. K. Chorley, F.R.E.S., and R. McChlery, B.A., B.Sc.

4/38. No. 1065. Nitrification in Red Soil in the Salisbury Area, by A. P. Taylor, M.A., B.Sc., and B. S. Ellis, B.Sc., A.I.C., D.I.C., Agricultural Chemists.

5-6/47. No. 1396. A Guide to some Rhodesian Soils, by B. S. Ellis, B.Sc., D.I.C., A.I.C., Chemistry Branch, Department of Agriculture.

DAIRYING.

12/38. No. 1094. Farm Butter Making, by The Dairy Branch.

1/41. No. 1170. The Manufacture of Cheddar Cheese, by The Dairy Branch.

3-4/43. No. 1228. The Manufacture of Gouda Cheese, by The Dairy Branch

3-4/44. No. 1260. The Dairying Industry, by the Dairy Branch.

5-6/44. No. 1264. Southern Rhodesia Milk Recording Scheme.

9-10/44. No. 1276. Cheese Making in the Home, by The Dairy Branch.

11-12/44. No. 1280. A Talk on Dairying, by F B. and M. Morrisby, Sunnyside Farm, Gwelo.

7-8/45, 9-10/45. No. 1321 Dairy Tests and Calculations, by The Dairy Branch.

9-9/46 & 1-2/47. Nos. 1361 & 1380. The Boltt Dairy Boiler, by the Dairy Branch.

7-8/47. No. 1400. Modern Milking, by the Dairy Branch.

7-8/47. No. 1401. The Dairying Industry, by J. R. Corry, B.Sc., Agric., Chief Dairy Officer.

7-8/47. No. 1405. The Milking Shed, by the Dairy Branch.

Blue prints of drawings of a Farm Dairy and Cowsheds can be obtained from the Chief Dairy Officer.

ENTOMOLOGY.

12/24 No. 522 Notes on the Black Citrus Aphis, by C. B. Symes.

8/25. No. 548. Insect Pests of Cotton, by C. B. Symes.

9/25. No. 553. Observations on some injurious markings of Oranges, by C. B. Symes, Entomologist.

7/30. No. 790. Notes on the Control of Some of the More Important Insect Pests of Citrus in Southern Rhodesia, by W. J. Hall, Ph.D., B.Sc., Entomologist to the British South Africa Company in Southern Rhodesia.

5/33. No. 892. The Tsetse Fly Problem in Southern Rhodesia, by R. W. Jack, Chief Entomologist.

5/33. No. 893. Experiments with Tsetse Fly Traps against *Glossina morsitans* in Southern Rhodesia, by R. W. Jack, Chief Entomologist.

7/33. No. 897. The Report of the Chief Entomologist for the year ending 31st December, 1932, by Rupert W. Jack, F.E.S., Chief Entomologist.

8/33. No. 899. The Black Maize Beetle (*Heteronchus Licus Klug*), by C. B. Symes.

2/34. No. 911. Screw Worm. A Pest of Ranch Cattle in Southern Rhodesia, by A. Cuthbertson, Entomologist. Foreword by R. W. Jack, Chief Entomologist.

3/34. No. 913. Locusts: Instructions for dealing with Flying Swarms, by The Division of Entomology.

12/34. No. 938. The Destruction and Control of Locust Hoppers, by R. W. Jack, Chief Entomologist.

8/35. No. 962. The Report of the Chief Entomologist for Year ending 31st December, 1934, by R. W. Jack, Chief Entomologist.

5/36. No 986. Annual Report of the Division of Entomology for year ending 31st December, 1935, by Rupert W. Jack, Chief Entomologist.

7/37. No. 1037. Division of Entomology: Annual Report for year 1936, by R. W. Jack, Chief Entomologist.

2/38. No. 1059. A Poison Bait for Young Locust Hoppers.

9/38. No. 1082. The Life History of Root Gallworm or Root Knot Eelworm, by M. C. Mossop, M.Sc., Entomologist.

4/39. No. 1105. Fumigation with Hydrocyanic Acid Gas, by M. C. Mossop, M.Sc.

8/39. No. 1121. Report of the Division of Entomology for the year ending 31st Decemb^r, 1938, by J. K. Chorley, Acting Chief Entomologist.

5/40. No. 1154. Host Plants of the Tobacco Aphis (*Myzus persicae*), by Chas. K. Brain, M.A., D.Sc.

8/40. No. 1160. The Tobacco Aphid, by Rupert W. Jack, Chief Entomologist.

9/40. No. 1161. Control of Maize Weevil (Calandra oryzae, L.), by M. C. Mossop, A.F.C., M.Sc., Entomologist.

7/41. No. 1177. Tsetse Fly Operations: Short Survey of the Operations by Districts, by J. K. Chorley, Entomologist. Extracted from the Annual Report of the Chief Entomologist.

10/41. No. 1184. Cultural Measures for Control of Root-Knot Eelworm, with Special Reference to Tobacco, by R. W. Jack, Chief Entomologist.

5-6/42. No. 1201. (a). The Skin Maggot Fly, by Alexander Cuthbertson, F.R.E.S., Entomologist.

3-5/42. No. 1205. Ticks Infesting Domestic Animals in Southern Rhodesia, by Rupert W. Jack, Chief Entomologist.

7-8/42 No. 1208. Tsetse Fly Operations: Short Survey of the Operations by Districts, for the year ending December, 1941, by J. K. Chorley, Entomologist.

3-4/43. No. 1227. Plant Pests from Abroad, by M. C. Mossop, M.Sc., Entomologist.

11-12/43. No. 1249. On the Activity of the Tsetse Glossina Pallidipes and other Tsetse during a 24 hour period, by W. L. Williams, B.Sc., Entomologist.

3-4/44. No. 1259. Damage to Sapwood of Hardwoods by Powder-Post Beetles, by the Division of Forestry and Entomology.

11-12/44. No. 1283. Tsetse Fly Operations, 1943, by J. K. Chorley, Acting Chief Entomologist.

1-2/45. No. 1288. Orthezia Bug, by E. C. G. Pinhey, B.Sc., Entomologist.

5-6/45. No. 1307. Conservation of Insect Control, by M. C. Mossop, M.Sc., Entomologist (Lecture delivered to Conservation Officers, Salisbury).

11-12/45. No. 1331. Tsetse Fly Operations: Short Survey of the Operations by Districts for the year ending December, 1944, by J. K. Chorley, Acting Chief Entomologist.

1-2/46. No. 1340. The Olive Bug, by E. C. G. Pinhey, B.Sc., Entomologist.

9-10/46. No. 1365. Compost and White Grubs in Tobacco Lands, by B. L. Mitchell, B.Sc., Entomologist.

11-12/46. No. 1373. White Grub Control in Tobacco Lands, by B. L. Mitchell, B.Sc., Entomologist.

11-12/46. No. 1377. Annual Report, Division of Entomology, 1945, by J. K. Chorley, Chief Entomologist.

3-4/47. No. 1388. The Sunn Hemp Beetles, by E. C. G. Pinhey, B.Sc., Entomologist.

FORESTRY.

11/29. No 763. The Utilisation of Wood, by T. L. Wilkinson, M.Sc., B.Sc.F.

4/30. No. 778. The Utilisation of Wood in Southern Rhodesia—Conversion and Disposal of Timber, by T. L. Wilkinson, M.Sc., B.Sc.F., District Forest Officer.

8/30. No. 791. The Utilisation of Wood in Southern Rhodesia: Fencing, by T. L. Wilkinson, M.Sc., B.Sc.F., District Forest Officer.

4/33. No. 888. The Vegetable Ivory Palm (*Hyphaene ventricosa*), by G. M. McGregor, B.Sc., District Forest Officer, Matabeleland.

12/35.	No. 974.	Summary of the Annual Report of the Division of Forestry for the year 1934, by E. J. Kelly-Edwards, M.A., Dip. For. (Oxon.), Chief Forest Officer.
3/37.	No. 1018.	Veld Fires. The Forest and Herbage Preservation Act, 1936, by E. J. Kelly Edwards, M.A., Dip. For. (Oxon.), Chief Forest Officer.
4/38.	No. 1068.	The Control of Veld Fires, by Division of Forestry.
7/38.	No. 1076.	Eighteenth Annual Report of the Division of Forestry for the year 1937, by E. J. Kelly Edwards, M.A., Dip. For. (Oxon.), Conservator of Forests.
1/40.	No. 1138.	Nineteenth Annual Report Division of Forestry for the year 1938, by E. J. Kelly Edwards, M.A., Dip. For. (Oxon.), Conservator of Forests.
12/41.	No. 1190.	Pitsawing, by E. J. Kelly Edwards, M.A., Dip. For. (Oxon.), Conservator of Forests.
9-10/42.	No. 1210.	Charcoal for Gas Producer Plants, by the Conservator of Forests in consultation with the Technical Sub-Committee on Producer Gas Plants.
3-4/44.	No. 1259.	Damage to Sapwood of Hardwoods by Powder-Post Beetles, by the Divisions of Forestry and Entomology.
7-8/44.	No. 1269.	Vermin and Notes on Methods of their Destruction, by the Vermin Conference Committee, assisted by E. Davison, Game Warden, Wankie Reserve.
11-12/44.	No. 1281.	Utilisation of Forests, by T. L. Wilkinson, M.Sc., B.Sc.F., Forest Officer, Matabeleland.
7-8/45.	No. 1313.	Forestry Notes for Conservation Officers. Part I. The Relation of Forests to General Conservation and to Conditions in Southern Rhodesia, by E. J. Kelly-Edwards, Conservator of Forests.
9-10/45.	No. 1320.	Forestry Notes for Conservation Officers. Part II. Uses of Indigenous Forests, Wind Breaks, General Tree Planting, by E. J. Kelly-Edwards, Conservator of Forests.
3-4/46.	No. 1346.	Wind-breaks and Shelter Belts, by A. A. Pardy, B.Sc. (Forestry), Forestry Division.
9-10/46.	No. 1368.	Raising and Planting of Trees on the Farm, by E. J. Kelly Edwards, M.A., Dip. For. (Oxon.), Conservator of Forests.
11-12/46.	No. 1375.	Timber Preservation—Butt Treatment, by R. H. Finlay.
1-2/47.	No. 1381.	Pitsawing, by E. J. Kelly Edwards, M.A., Dip. For. (Oxon.), Conservator of Forests.
1-2/47.	No. 1382.	The Pot Planting of Eucalypts, by Major G. R. Wake, Vigila, Umvukwes.
1-2/47.	No. 1383.	Summary of the Twenty-Sixth Annual Report of the Division of Forestry for the year 1945, by E. J. Kelly Edwards, M.A., Dip. For. (Oxon), Conservator of Forests.
3-4/47.	No. 1391.	Some Trees, Shrubs, Shrubby-Herbaceous Plants, Climbers and Water Plants suitable for the Colony, by J. W. Barnes.
5-6/47.	No. 1395.	Price List of Forest Tree Transplants, Ornamental Trees and Shrubs, Hedge Plants, Creepers, and Seeds obtainable at Government Forest Nursery, Salisbury.

HORTICULTURE.

2/29. No 725. Investigations into "Collar-Rot" Disease of Citrus, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A. (Trinidad)

11/31. No. 834. Celery Culture, by G. W. Marshall, Horticulturist.

2/33. No. 876. Notes on African Aloes (Parts 1-6), by H. Basil Christian, "Ewanrigg," Arcturus.

10/33. No. 905. Notes on African Aloes (Parts 7-10), by H. Basil Christian, "Ewanrigg," Arcturus.

7/35. No. 960. The Rhodesian Home Orchard, by G. W. Marshall, Horticulturist.

4/40. No. 1150. The Health of Seed Potatoes, degeneration due to virus diseases is the greatest source of loss. Journal of the Ministry of Agriculture, December, 1939.

1-2/44. No. 1255. The Commercial Culture of Cape Gooseberries, by R. G. Skipwith, Umtali.

1-2/45. No. 1293. Tomato Culture, by G. W. Marshall, Government Horticulturist.

9-10/45. No. 1322. Price List of and Ornamental Trees obtainable from Sub-Tropical Experiment Station, Umtali.

7-8/47. No. 1408. Tung Nut Growing, by C. N. Hayter, F.Inst. P.A. (S.A.), Government Horticulturist.

IRRIGATION, WATER SUPPLIES AND SOIL EROSION.

6/35. No. 956. Annual Report of the Division of Irrigation for the year ended 31st December, 1934, by P. H. Haviland, B.Sc. (Eng.), Acting Chief Irrigation Engineer.

1/39. No. 1095. Soil and Water Conservation, by D. Aylen, for the Irrigation Division.

7/39. No. 1117. Soil and Water Conservation. Part II. By D. Aylen and Irrigation Officers.

3-4/42. No. 1196. Gully Control: Some Recent Successes, by D. Aylen, Technical Assistant for Soil Conservation.

7-8/43. No. 1238. A Reinforced Concrete Roof for Circular Reservoirs, by H. W. H. Wallis, B.Sc., Assoc.M.Inst.C.E., Assistant Irrigation Engineer.

9-10/43. No. 1241. Stone Packed Weirs, by R. H. Roberts, B.Sc., A.M.Inst.C.E., Acting Director of Irrigation.

5-6/46. No. 1350. Annual Report of Irrigation Department for 1945.

5-6/46. No. 1352. Use of Brick Weirs in Control of Gullies, by E. S. White, Esq., "Bretton Farm."

7-8/46. No. 1358. Small Earthen Storage Dams, by the Irrigation Dept.

7-8/47. No. 1402. Annual Report of Irrigation Dept. for 1946, by the Director of Irrigation.

LIVESTOCK.

12/33. No 907. The Blackhead Persian: Its Breeding and Management in Matabeleland, by C. A. Murray, M.Sc., Lecturer in Animal Husbandry, Matopo Estate.

5/36. No. 987. The Curing of Hides and Skins on the Farm, by The Division of Animal Husbandry.

5/36. No. 988. Preparing Cattle for Show, by The Animal Husbandry Division.

6/36. No. 989. The Supplementary Feeding of Mineral and Protein Supplements to Growing Cattle in Southern Rhodesia and its Relation to Production of Beef Steers, by the Division of Animal Husbandry.

1/37. No. 1012. Export of Frozen Porkers and Baconers. Fourth Consignment to Smithfield, by Division of Animal Husbandry.

4/37. No. 1023. Cowpea Molasses Silage for Fattening Steers, by C. A. Murray, M.Sc. (Agric.), Senior Animal Husbandry Officer in Charge, Matopo School of Agriculture and Experiment Station; A. E. Romyn, Ph.D., Chief Animal Husbandry Officer, Department of Agriculture, Salisbury; R. H. Fitt, Dipl. Agric., Animal Husbandry Officer, Department of Agriculture, Salisbury.

4/37. No. 1024. Comparative Feeding Value of Maize Meal and Nyouti (*Pennisetum typhoides*) Meal for Fattening Steers, by C. A. Murray, Senior Animal Husbandry Officer in Charge, Rhodes Matopo Estate; A. E. Romyn, Chief Animal Husbandry Officer.

12/37. No. 1049. The Export of Frozen Porkers: Report on Five Consignments of Porkers Exported to Smithfield, by Division of Animal Husbandry.

11/38. No. 1091. Cost of Fattening Bullocks of various ages in Matabeleland, by A. E. Romyn and C. A. Murray.

7/39. No. 1120. Urea as a possible substitute for Peanut Cake for Wintering Young Stock, by C. A. Murray and A. E. Romyn.

1/40. No. 1140. The Summer Fattening of Bullocks, by the Division of Animal Husbandry.

2/40. No. 1143. Larger Calf Crops will increase your Profits, by C. A. Murray, Senior Animal Husbandry Officer in Charge, Government Experiment Station, Matopos.

3/40. No. 1147. A Home-made Cow Stanchion, by Major R. R. Sharp, Whinburn, Redbank.

3-4/42. No. 1198. Soft Fat in Bacon Pigs, by C. A. Murray, Division of Animal Husbandry.

3-4/45. No. 1299. Choice Beef, by the Division of Animal Husbandry.

11-12/45. No. 1327. Hand Rearing of Dairy Calves, by C. A. Murray and A. E. Romyn, Division of Animal Husbandry.

3-4/46. No. 1342. The Raising of Bacon Pigs, by A. E. Romyn, Chief Animal Husbandry Officer; C. A. Murray, Senior Animal Husbandry Officer, and a Veterinary Section by D. A. Lawrence, Director of Veterinary Research.

5-6/46. No. 1351. Feeding of Dairy Cows, by the Division of Animal Husbandry.

7-8/46. No. 1354. Winter Cereal Grazing for the Production of Fat Lambs—Press Service, Department of Agriculture, Pretoria.

7-8/46. No. 1355. Annual Report of the Chief Animal Husbandry Officer for 1945.

7-8/47. No. 1403. Sheep and Their Management in Southern Rhodesia, by C. A. Murray, Chief Animal Husbandry Officer.

METEOROLOGICAL.

12/24. No. 524. The Use of an Aneroid Barometer, by C. L. Robertson, B.Sc., A.M.I.C.E.

10/28. No. 712. The Time, and How to Find It, by N. P. Sellick, M.C., B.Sc. (Eng.).

2/33. No. 877. Clouds and Weather in Southern Rhodesia, by N. P. Sellick, M.C., B.Sc., Meteorologist.

PASTURES.

2/37. No. 1016. Natural Protection from Soil Erosion, by S. D. Timson, M.C., Assistant Agriculturist.

4/38. No. 1068. The Control of Veld Fires, by the Division of Forestry.

9/38. No. 1081. Uncontrolled Grass and Forest Fires and their Prevention, by the Rev. Father A. B. Burbridge, S.J.

9-10/44. No. 1274. Pastures for Soil Fertility, by Dr. J. Fischer, Principal, College of Agriculture, Cedara.

11-12/44. No. 1282. Improved Pastures on Sandveld Vleis, by the Pasture Research Committee.

9-10/46. No. 1366. Report on Tour of Pasture Research Stations in Union of South Africa, by J. M. Rattray, M.Sc., Pasture Research Officer.

9-10/46. No. 1367. Some Fundamental Aspects of Modern Pasture Management, by H. Weinmann, Dr. Agric., M.Sc., Pasture Research Chemist.

1-2/47. No. 1384. Prelim. Results in Improving the Sandveld Vleis on the Grassland Experiment Station, Marandellas, by J. M. Rattray, Pasture Research Officer, and R. H. Fitt, Animal Husbandry Officer.

7-8/47. No. 1409. Giant Rhodes Grass Pastures at Trelawney, by J. M. Rattray, M.Sc., Pasture Research Officer.

PLANT PATHOLOGY AND BOTANY.

PLANT PATHOLOGY.

2/29. No. 725. Investigation into "Collar-Rot" Disease of Citrus, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A. (Trinidad).

6/29 No. 742. What is Diplodia in Maize? An Answer to a Popular Question To-day, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.

9/29. No. 754. "Pinking" of Maize: Report of a Preliminary Investigation, by T. K. Sansom, B.Sc., Plant Breeder.

11/30. No. 798. The Preparation of Bordeaux Mixture and Seasonal Notes on Tobacco Diseases, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.

9/32. No. 861. Further Notes on Leaf Curl of Tobacco in Southern Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), Plant Pathologist.

6/33. No. 894. Mycological Notes. Seasonal Notes on Tobacco Diseases. 6. An Unusual Type of Frog Eye Spotting, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Government Plant Pathologist.

10/34. No 934. Mycological Notes. Seasonal Notes on Tobacco Diseases. 7, Spraying in Seed-beds and Lands, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

1/35. No. 942. Mycological Notes. Seasonal Notes on Tobacco Diseases. 8, The Mosaic Mystery. 9, Danger Points in Field Spraying, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

4/35. No. 951. Suspected "Streak" Disease of Maize. Notice to Growers, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

6/35. No. 957. Annual Report of the Branch of Plant Pathology for the year ending 31st December, 1934, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

10/35. No. 969. The Objects and Value of Seed Treatment of Maize against Diplodia, by G. M. Wickens, Ph.D. (Lond.), D.I.C., Assistant Plant Pathologist.

4/37. No. 1022. Smut Diseases of Wheat in Southern Rhodesia, by G. M. Wickens, B.Sc., Agric., Ph.D., D.I.C., Tobacco Research Station, Trelawney.

6/38. No. 1074. A Note on a Stem Rot of Sweet Peas, by J. C. F. Hopkins, D.Sc., A.I.C.T.A., Senior Plant Pathologist.

8/39. No. 1122. Report of the Branch of Plant Pathology for the year ending 31st December, 1938, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

10/39. No. 1128. Mycological Notes. 12. The Diplodia Danger, by J. C. F. Hopkins, D.Sc., A.I.C.T.A., Senior Plant Pathologist.

12/39. No. 1134. Mycological Notes. 14. Seasonal Notes on Plant Diseases, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

8/41. No. 1180. Diseases of Fruit, Flowers and Vegetables in Southern Rhodesia: 3. Common Diseases of Snapdragons, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

12/41. No. 1188. Diseases of Fruit, Flowers and Vegetables in Southern Rhodesia: No. 5, Diseases of Potatoes, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

9-10/42. No. 1213. Diseases of Fruit, Flowers and Vegetables in Southern Rhodesia: No. 6. Virus Diseases of Cabbages and Cauliflowers, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., and Marie H. Pardy, B.Sc., Branch of Plant Pathology.

1-2/43. No. 1226. Mycological Notes. No. 16. The Campaign against Kromnek Virus, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

3-4/44. No. 1257. Diseases of Fruit, Flowers and Vegetables in S.R. No. 8, "The Yellows Disease of Cabbage," by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., and Marie H. Pardy, B.Sc.

9-10/45. No. 1314. The Ground Nut: Importance of Seed Disinfection, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

3-4/46. No. 1343. Tobacco: Alternaria (Brown) Leaf Spot of, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

7-8/46. No. 1359. Annual Report of the Branch of Botany and Plant Pathology for 1945, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

BOTANY.

9/31. No. 826. Some Poisonous Plants of Southern Rhodesia, by Sydney M. Stent, Senior Botanist.

1/32. No. 841. Poisonous or Suspected Poisonous Plants of Southern Rhodesia: Tulip Poisoning of Cattle, by Sydney M. Stent, Senior Botanist, and D. A. Lawrence, B.V.Sc., Veterinary Research Officer.

2/33. No. 876. Notes on African Aloes (Parts 1-6), by H. Basil Christian, "Ewanrigg," Arcturus.

10/33. No. 905. Notes on African Aloes (Parts 7-10), by H. Basil Christian, "Ewanrigg," Arcturus.

2/39. No. 1099. Trees and Wild Flowers on the Rhodesian Farm. Part II. By Chas. K. Brain, M.A., D.Sc., Director of Agriculture.

3/39. No. 1102. Trees and Wild Flowers on the Rhodesian Farm. Part III. By Chas. K. Brain, M.A., D.Sc., Director of Agriculture.

4/39. No. 1106. Trees and Wild Flowers on the Rhodesian Farm. Part IV. By Chas. K. Brain, M.A., D.Sc., Director of Agriculture.

5/39. No. 1112. Trees and Wild Flowers on the Rhodesian Farm. Part V. By Chas. K. Brain, M.A., D.Sc., Director of Agriculture.

6/39. No. 1116. Trees and Wild Flowers on the Rhodesian Farm. Part VI. By Chas. K. Brain, M.A., D.Sc., Director of Agriculture.

7/39. No. 1119. Trees and Wild Flowers on the Rhodesian Farm. Part VII., by Chas. K. Brain, M.A., D.Sc., Director of Agriculture.

8/39. No. 1123. Trees and Wild Flowers on the Rhodesian Farm. Part VIII. By Chas. K. Brain, M.A., D.Sc., Director of Agriculture.

9/39. No. 1125. Trees and Wild Flowers on the Rhodesian Farm. Part IX. By Chas. K. Brain, M.A., D.Sc., Director of Agriculture.

12/39. No. 1133. Trees and Wild Flowers on the Rhodesian Farm. Part X. By Chas. K. Brain, M.A., D.Sc., Director of Agriculture.

1/40. No. 1139. Trees and Wild Flowers on the Rhodesian Farm. Part XI. By Chas. K. Brain, M.A., D.Sc., Director of Agriculture.

3/40. No 1146. Trees and Wild Flowers on the Rhodesian Farm. Part XII By Chas. K. Brain, M.A., D.Sc., Director of Agriculture.

1-2/45. No. 1284. Botanical Specimens for Identification—Correct Methods of Collecting and Despatching, by the Division of Botany and Plant Pathology.

11-12/46. No. 1379. Upright Star-Bur. A New Method of Control, by H. Wild, Ph.D., D.I.C., Division of Botany and Plant Pathology.

5-6/47. No. 1393. The Eastern Districts Senecio Problem, by H. Wild, Ph.D., D.I.C., Division of Botany and Plant Pathology.

POULTRY.

3/27. No. 635. Ovarian Troubles, by A. Little, Poultry Expert.

11/41. No. 1186. Sex-Linkage in the Pure Black Australorp, by G. H. Cooper, Assistant Poultry Officer.

1-2/45. No. 1289. Vicious Habits in Poultry, by The Poultry Branch.

3-4/45. No. 1302. Feeds for Poultry and How to Use Them, by G. H. Cooper, Assistant Poultry Officer.

7-8/45. No. 1312. Rearing and Fattening of Table Poultry, by H. G. Wheeldon, Chief Poultry Officer.

9-10/45. No. 1323. Poultry Industry: Care of Young Stock in Hot Weather, by H. G. Wheeldon, Chief Poultry Officer.

9-10/45. No. 1324. Trap Nests, by H. G. Wheeldon, Poultry Officer, and B. G. Gundry, A.I.Mech.E.

11-12/45. No. 1329. A Cheap Portable Colony House for Poultry, by G. H. Cooper, Assistant Poultry Officer.

1-2/46. No. 1339. Modern Culling of Laying Hens, by G. H. Cooper, Assistant Poutry Officer.

9-10/46. No. 1370. Housing and Feeding Adult Poultry Stock, by H. G. Wheeldon, Poultry Officer.

11-12/46. No. 1376. Ducks on the Farm, by H. G. Wheeldon, Poultry Officer.

3-4/47. No. 1390. The Artificial Incubation, Brooding and Rearing of Chickens, by H. G. Wheeldon, Poultry Officer.

5-6/47. No. 1394. The Moult, by H. G. Wheeldon, Poultry Officer.

PAMPHLETS.

The following pamphlets can be obtained from the Poultry Officer upon application:—

Chicken-pox, by The Poultry Branch.

Coccidiosis, by The Poultry Branch.

Conditions of Birds on Show, by A. Little, Poultry Expert.

Diseases of the Liver, by The Poultry Branch.

Heart Trouble, by A. Little, Poultry Expert.

Grow Sunflowers, by The Poultry Branch.

Poultry Rations, by H. G. Wheeldon, Poultry Officer.

Preparing Birds for Show, by The Poultry Branch.

Respiratory Disease of Poultry, by The Poultry Branch.

Visceral Gout of Fowls, by J. D. W. A. Coles, Veterinary Research Officer, Onderstepoort.

TOBACCO.

12/36. No. 1009. Tobacco Research on the Trelawney Station 1935-36 Season.

4/37. No. 1025. Report of the Tobacco Research Board, by Chas. K. Brain, M.A., D.Sc., Director of Agriculture and Chairman of the Tobacco Research Board.

3/38. No. 1063. A New and Serious Disease of Tobacco in Southern Rhodesia, by G. M. Wickens, Ph.D., D.I.C., Plant Pathologist, Tobacco Research Station, Trelawney.

6/38. No. 1072. Report of the Tobacco Research Board for the year ending 31st December, 1937, by Chas. K. Brain, M.A., D.Sc., Director of Agriculture, and Chairman of the Tobacco Research Board.

3-4/43. No. 1229. Use of Compost in the Manurial Treatment of Flue-cured Tobacco, by D. D. Brown, Chief Tobacco Officer.

VETERINARY.

5-6/47. No. 1392. Quarter Evil, by D. A. Lawrence, B.V.Sc., Director of Veterinary Research.

5-6/47. No. 1397. Scheduled Diseases of Stock in Southern Rhodesia, by the Veterinary Department.

MEMOIRS.

5/39. No. 1. "Studies in the Physiology and Behaviour of *Glossina morsitans*, Westw.," by Rupert W. Jack, Chief Entomologist. Pp. 203 + vii.

12/39. No. 2. "Descriptive List of Plant Diseases in Southern Rhodesia (and their Control)," by J. C. F. Hopkins, D.Sc. Pp. 51. Price 1/-.

8/41. No. 3. "Further Studies in the Physiology and Behaviour of *Glossina morsitans*, Westw.," by Rupert W. Jack, Chief Entomologist. Pp. 56.

MISCELLANEOUS.

4/28. No. 686. The Land Bank, Its Functions and How it Operates, by S. Thornton.

4/28. No. 687. The Use of Explosives on the Farm, by P. H. Haviland, B.Sc. (Eng.).

5/31. No. 820. The Great Economic Problem in Agriculture—No. 1, by J. R. McLoughlin, M.Sc. (Economist), Economic Adviser.

1/36. No. 975. Fertilizers, Farm Foods, Seeds and Pests Remedies Ordinance, 1914.

9/38. No. 1081. Uncontrolled Grass and Forest Fires and their Prevention, by the Rev. Father A. B. Burbridge, S.J.

4/39. No. 1107. Some Notes on Game Bird Preservation, by W. E. Poles, Esq., on behalf of the Wild Life Protection Society of Southern Rhodesia.

6/39. No. 1114. The Rhodes Inyanga Estate.

7/39. No. 1118. Grass Fires and Fire-belt Burning, by J. R. Perrins, P.B.S. Ranch, Fort Rixon.

7-8/45. No. 1311. Report of Secretary, Department of Agriculture and Lands, 1944.

9-10/45. No. 1316. Post-war Land Settlement in Southern Rhodesia.

11-12/45. No. 1328. Baited Fly Traps, by Dr. D. M. Blair, Public Health Department, Salisbury.

11-12/45. No. 1330. Control of the Snail Hosts of the Bilharzia Parasites, by Dr. D. M. Blair, Public Health Department, Salisbury.

1-2/46. No. 1335. Brick-making on the Farm, by A. C. Jennings, Assoc. Mem. Inst. C.E.

3-4/46. No. 1344. Baited Fly Traps (Supplement), by Dr. D. M. Blair, Public Health Department, Salisbury.

3-4/46. No. 1347. How to make use of the Fencing Law and Preservation of Farm Beacons, by the Lands Department and L. M. McBean, Surveyor General.

5-6/46. No 1349. Annual Report of Secretary, Department of Agriculture and Lands, 1945.

7-8/46. No. 1357. Annual Report of Central Food Production Committee, 1945.

9-10/46. No. 1363. The Coverage of Tractor-Drawn Implements, by E. J. Waring, B.Sc.Agr., reprinted from Agricultural Journal, N.S.W.

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Agricultural Experimental Station, Salisbury.

Annual Report of Experiments, Season 1945/46.

(By H. C. ARNOLD, M.B.E., Manager.)

Rainfall. The season opened early with a few useful showers in October and Early November, but during the latter part of November and early December, which is the planting season, very little rain fell, and consequently the stands of some of the crops were incomplete. January brought exceptionally frequent and heavy showers, but except for one short period in February, droughty conditions prevailed for the remainder of the season.

Analysis of Rainfall, Season 1945/46.

Month	Number of rain days	Total for the month	Number of rains over ¼ of an inch	Total for the season	Periods exceeding one week without effective rainfall
October	5	.82	2	.82	Oct. 25th to Nov. 7th.
November	11	3.16	3	3.98	Nov. 13th to 22nd; Nov. 24th to Dec. 6th; Dec. 12th to 21st.
December	13	7.56	7	11.54	
January	23	13.60	14	25.14	Nil.
February	12	4.38	5	29.52	Feb. 1st to 9th; Feb. 17th to 23th.
March	8	2.62	2	32.14	Mar. 1st to 20th; Mar. 22nd to Apr. 7th.
April	3	1.11	1	33.25	
Total	75	33.25	34	33.25	8 periods.
Average for previous 10 years	82	34.8	42	—	

The excessive rains during the last week of December and in January leached the soluble nitrogen compounds from the soils and weakened the growth of the plants. After the floods, drought set in and retarded the growth of the plants still further. These unfavourable climatic conditions combined to reduce crop yields.

The results of experiments conducted at this Station since the year 1919 have been published in Bulletin form, and, with a few exceptions, these are still available. To facilitate comparison, this report is drawn up on lines similar to previous ones.

CROP ROTATION EXPERIMENTS.
First Series, 1913-1946.

Maize Yields in Bags per Acre.

System of Cropping	1945-46 Rainfall 33.25	1944-45 Rainfall 34.59	1943-44 Rainfall 34.56	1942-43 Rainfall 45.15	1941-42 Rainfall 26.42	1940-41 Rainfall 31.77	Average Yield
*System A.— Plot A1: Maize continuous. Green manure & 250 lbs. per acre of phosphatic fertiliser in the following season	16.45	G.M. p.u.	9.20	11.65	G.M. p.u.	8.53	12.69 (12 crops)
*System A.— Plot A2: Maize continuous. Fertiliser only, rate as above	4.45	5.38	8.93	4.15	5.12	4.33	6.15 (18 crops)
†System B.— Alternate Maize & Beans for hay; no manure or fertiliser	5.58	3.89	8.80	4.34	5.18	6.58	8.23 (31 years)
System C.— Three-course rotation: Maize, velvet beans (reaped), oats; no manure or fertiliser	4.65	6.18	6.18	5.15	9.48	8.00	11.50 (31 years)
System D.— Four-course rotation: Maize (plus 6 tons dung per acre), oats, bean hay, maize. Average of two plots	10.15	13.17	12.08	5.74	9.95	12.62	14.61
Maize (no manure direct)	9.33	14.78	12.63	5.90	8.53	15.20	15.02 (30 years)
Maize (dunged plots)	10.96	11.56	11.53	5.57	11.37	10.03	14.20

* Having grown maize for 15 years in succession without manure or fertiliser, during which time its yields gradually decreased until they had become negligible, this plot had served its purpose. With the object of comparing two methods of again raising the cropping power of such land to a more profitable standard, the whole plot was treated with a mixture of one-third bone and two-thirds super-phosphate at the rate of 250 lbs. per acre at the beginning of 1928-1929. One-half of the plot was sown to a mixture of sunn hemp and velvet beans, which were subsequently ploughed in. This manurial treatment was repeated on the respective plots during the seasons 1932-1933, 1935-1936, 1938-1939, 1941-1942 and 1944-1945.

† In 1929-1930 this system was amended from "Alternate Maize and Bare Summer Fallow to "Alternate Maize and Beans for Hay."

System A. It is now 18 years since this plot was divided and the present system adopted. The returns show that in spite of unfavourable climatic conditions the part of the plot which was green-manured last season yielded a heavy crop and that its yield was more than three times as much as that of the other plot where maize is grown continuously. During the 18-year period, 1928-46, a total of 152.27 bags per acre have been reaped on the green-manured section, but only 110.71 bags have been obtained where maize has been grown continuously. This shows an increase of approximately 40 per cent. in favour of the land which has been green-manured every third year in addition to receiving a moderate application of phosphatic fertiliser.

System B. In this system the land is cropped to maize on alternate years only, and hence it yields only half as many crops during a given period as the land in System A, where maize is grown continuously. The yield of 5.58 bags per acre recorded this season compares very unfavourably with that of 16.45 bags per acre obtained in System A, where the land is green-manured periodically and phosphate is applied. Although the introduction of the leguminous hay crop in the place of "bare summer fallow" had a beneficial effect on the maize yields for a few years, the comparatively low yields obtained during recent years indicate that this land is deficient in humus and available phosphate.

System C. The yield recorded for this rotation during the season under review is lower than could be expected. The effect of the rotational treatment can be more accurately gauged by considering the average yield over a number of years rather than that of the current year only. The inherent fertility of the individual plots affects the yields, as well as the rainfall and the rotational treatment.

System D. The maize yields in this rotation during the past three seasons have been approximately twice as heavy as those in the systems which receive no application of organic material. That so small a dressing should have such a large effect is indeed surprising. These results indicate that the low yields in the contemporary rotations may be largely due to lack of humus. It has been noted in previous reports that the yield of the maize crop to which the dung was directly applied was frequently less than that of the other maize crop which occurs in this rotation four years after the application of manure. This indicates that the beneficial effect of the manure is spread over a number of years. Its immediate effect may be influenced by the quantity and incidence of the rainfall. The records show that in the season 1942-43, when the precipitation was much heavier than usual, the manurial dressing had no effect. The yield recorded that year was 5.57 bags per acre, whereas the yield from the same plot, during the season under review, was 9.33 bags per acre. The effect exerted by the manurial dressing on the maize yields of the current season will depend on the degree of decomposition of the vegetable matter at the time of application, as well as the climatic conditions during the growing season. It is usually more effective when the rains are not excessive during the season of application. During the 22 years in which the farmyard manure has been applied to maize in this rotation, the total yield

of the crops immediately following the manurial dressings amount to 312 bags per acre, while the yields of the crops which have occurred in the rotation four years after the application of manure total 314 bags per acre.

It may be noted that the total yield in bags per acre for the past four years (1943-1946) in Systems A2, B and C, are practically the same, viz., 22.56 plus or minus .4. This indicates that the various methods of cropping the land have all had the same effect on its productivity. They show that although rotational cropping systems in which reaped legumes are included may be a means of obtaining heavier cereal crops for a short period, the point is reached sooner or later (depending on the inherent fertility of the soil) when the yields begin to decline, and the downward trend continues until it is checked by applications of plant foods in the form of humus and phosphates. The results recorded plainly show the necessity for farmers to adopt balanced systems of husbandry, which will provide for the return of humus-making material to the soil, either in the form of green manure or a compost made from other vegetable wastes. When such applications are fortified with phosphatic fertiliser, it is likely that increased profits will be obtained.

SECOND SERIES OF CROP ROTATIONS.

These rotations were laid down in 1919-1920 and were designed to evolve a system of cropping which would meet the needs of farmers who could not adopt a system of mixed farming. The series includes two plots, A and F, on which maize has been grown continuously, excepting that, in the season 1938-1939, on one-half of Plot A a green manure crop was grown, the top-growth of which was composted and returned to the same plot in order to ascertain the effect of a humus dressing on land which has been continuously cropped to maize for 20 years; this treatment has been repeated every third season since the year 1939. No artificial fertiliser has been applied to Plot A at any time. On Plot F, commencing season 1929-1930, phosphatic fertiliser is applied in alternate years. The fertiliser given to this plot is the same in quantity and quality as that accorded in rotational System H, but dressings of organic material are entirely omitted.

During the season 1940-1941, further changes were made in this series, affecting rotational systems F and H. At the time of their inception maize was the only "cash" crop that could be grown on a large scale in this Colony, but during the past few years strains of soya beans suitable for large-scale cultivation have been evolved, and may, at some future date, form a welcome addition to our cropping system. With the object of ascertaining the effect of introducing soya beans into these systems of cropping, the original plots were divided so that in future the old system will be continued on one half, adjacent to the amended system on the other half of the plots.

System E, Plot A. Maize continuously for 26 years. Commencing season 1938-1939, on one half (A.1) green manure crops were grown, the top-growth of which was composted and returned again to the same plot. During the two seasons following, maize was

sown, and in the seasons 1941-1942, 1944-1945 cropping with legumes for composting and returning to the land again was repeated. On the adjacent section (A.2) maize has been sown each year.

Seasons and Yields of Maize in Bags (200 lbs.) per Acre.

	1945-46	1944-45	1943-44	1942-43	1941-42	1940-41	Average
A1.	9.68	G.M. crop composted	7.65	9.90	G.M. crop composted	6.95	9.26 (5 crops)
A2.	2.92	5.85	5.72	1.45	3.60	4.63	4.39 (8 crops)

The beneficial effect exerted by composted vegetable material when it is applied to land which has been rendered deficient in available plant food by continuous cropping is plainly shown by the returns from this plot. The yield of the part which received the compost is more than three times as heavy as that of the other half of the plot, which has received no manurial dressing. The returns from this plot are comparable with those obtained in System A, but the yields are lower, because no phosphatic fertiliser has been applied at any time.

System F, Plots B to E. Three-quarters of the land under maize, one-quarter under Sudan grass. Each year one section under maize, commencing with Plot B in 1919-1920, received eight tons of farmyard manure per acre, and commencing on Plot E, in 1929-1930, the section which grew Sudan grass the previous season receives 200 lbs. per acre of phosphatic fertiliser.

Maize Yields in Bags of 200 lbs. per Acre.

	1945-46	1944-45	1943-44	1942-43	1941-42	1919-20	Average 1920-46
Plot B	Sudan	9.40	12.70*	7.78†	Sudan	26.0	15.25
Plot C	9.10	14.23*	9.28†	Sudan	10.30	23.7	13.99
Plot D	8.82*	7.45†	Sudan	6.45	9.55*	Sudan	13.22
Plot E	5.22*	Sudan	12.80	7.30*	7.10†	24.6	13.87
Average	7.71	10.37	11.59	7.84	8.98	24.7	14.08

* Indicates the application of farmyard manure.
† Indicates the application of 200 lbs. per acre of phosphatic fertiliser.

In spite of the application of 8 tons of farmyard manure and 200 lbs. of phosphatic fertiliser to this land during every four-year period, the yields have gradually declined. During the season under review the average is seen to be less than a third of that recorded for the season 1919-1920, when the trials commenced. A more accurate estimate of the effect of this rotational system on the productivity of the soil can be gauged by comparing the average yield for the first 5-year period 1920-1924 with that of the last 5-year period 1942-1946. The yields are 19.4 and 9.3 bags per acre respectively.

In the amended rotation the Sudan grass and the intermediate crop of maize are replaced by soya beans, so that the land is now cropped to maize and soya beans, on alternate years. The farmyard manure is applied to one of the soya bean crops, but the phosphate is applied to one of the maize crops.

In the tabulation below, the yields obtained on the amended rotation are shown adjacent to those in the original system.

Maize and Soya Bean Yields in Bags of 200 lbs. per Acre.

	1945-46		1944-45		1943-44	
	New System	Old System	New System	Old System	New System	Old System
Plot B	B 4.43	Sudan	M15.53	M 9.40	B 8.55*	M12.70*
Plot C	M14.92	9.10	B 8.20*	M14.25*	M18.00†	M 9.28†
Plot D	B 5.82*	8.82*	M14.45†	M 7.45†	B 7.80	Sudan
Plot E	M11.90†	5.22†	B 5.90	Sudan	M20.68	M12.80
Average Maize Yield	13.42	7.71	14.99	10.33	19.34	11.59
Average Bean Yield	5.13	—	7.05	—	8.18	—

M, Maize; B, Soya Beans; Sudan, Sudan Grass.
* Indicates the application of farmyard manure.
† Indicates the application of 200 lbs. per acre phosphatic fertiliser.

The average yield of the maize crops in the amended rotation was nearly twice that of the average in the old system. The yield of the soya beans was less than in previous years, but at the prices ruling at reaping time, the market value of the combined crops in the amended rotation was approximately twice as much as that of the crops in the old rotation. This system of cropping seems to be a very satisfactory one, for it provides material which can either be marketed as soon as it is harvested or it may be fed to animals on the farm. The manurial dressings maintain the productive capacity of the soil at a fairly high level. In farm practice other crops than those actually used in this system could be grown. The

soya beans could be either wholly or partially replaced by ground nuts, velvet beans or some other leguminous crop. Instead of cropping half of the land to maize, a part of it could be sown to other grass crops for use as hay or as silage if the farmer found that such a system was more suited to his requirements.

System G, Plot F. Maize continuously. No manure or fertiliser during the first 10 years. Commencing season 1929-1930, fertiliser similar in kind and in quantity to that provided in System H has been applied to this plot.

Seasons and Yield of Maize in Bags per Acre.

1945-6	1944-5	1943-4	1942-3	1941-2	1919-20	Average over 27 years
3.8*	4.80	9.45*	4.68	4.55*	23.3	9.6

* Indicates the application of 200 lbs. per acre fertiliser.

In spite of an application of 200 lbs. per acre of phosphatic fertiliser at the beginning of the season, the yield obtained is one of the lowest recorded since the commencement of these trials 27 years ago. The low yields during recent years show that applications of phosphatic fertiliser to land which is deficient in humus are likely to prove unprofitable.

System H, Plots G to K. Three-quarters of the land under maize, one-quarter under velvet beans, which are ploughed under for green manure. From the commencement of this experiment until 1928-1929, this land received one green manuring and one application of fertiliser during each period of four years. The returns from these plots showed that insufficient plant food had been supplied to maintain fertility, and the manurial system was then amended to provide for two dressings of fertiliser during each four-year period. The crop of maize which follows the green manuring now receives 200 lbs. super-phosphate per acre, which should enable it to make the best use of the nitrogen supplied by the green manure; the second maize crop receives no fertiliser, and the third crop—that immediately in front of the bean crop—receives 200 lbs. per acre of raw rock phosphate.

Seasons and Maize Yields in Bags per Acre.

Plot	1945-46	1944-45	1943-44	1942-43	1941-42	1919-20	Average 1920-46
G	Beans	6.50*	11.05	12.33*	Beans	23.10*	13.36
H	5.10*	6.70	18.55*	Beans	6.70*	23.00	13.88
J	6.92	19.70*	Beans	4.75	7.20	Beans	12.77
K	16.35*	Beans	12.08*	6.70	11.63*	19.20	13.39
Average	9.46	10.97	13.89	7.93	8.51	21.70	13.35

* Denotes the application of fertiliser.

The great difference between the high yield of the crop which follows immediately after the green manure and those which occur later in the rotation is the most interesting feature of this system. The beneficial effect of this rotational system is apparent from the difference in the average yield of these plots, namely, 9.46 bags per acre, and that of the plot in System G, which is only 3.8 bags per acre. This difference is largely due to the effect of the green manure, because the same amount of phosphatic fertiliser is supplied in both rotations.

Comparison of the yields from the various plots in Systems F and H show that the beneficial effect of the farmyard manure is spread over a longer period than that of the green manure, which is used as the source of humus is System H. This point is shown more clearly by the following tabulation, which gives the total yields recorded during the 15-year period 1932-1946, of the first, second and third crops following the application of the specific organic material.

Maize Yields in Bags of 200 lbs. per Acre. Period 1932-46.

Manurial Treatment during each 4-year period	1st Crop	2nd Crop	3rd Crop*	Total over 15 years
System F.—				
8 tons farmyard manure plus 200 lbs. 19% super-phosphate	196	174	159	529
System H.—				
Green manure plus 200 lbs. super plus 200 lbs. rock phosphate	261	134	137	532

* In both systems the last crop receives a dressing of 200 lbs. of phosphatic fertiliser.

Actually, the crop described as "3rd" occurs in the 4th year in System F where it is preceded by Sudan grass. The total yields of maize reaped in these systems is practically the same for both, but when comparing their efficiency for maintaining the productivity of the soil, it must be remembered that System F yields a crop of Sudan grass each fourth year in addition to the maize shown in the tabulation. In System H the first crop following the green manuring is as large as the next two crops combined. This suggests that some farmers might find it more profitable to adopt a biennial system of green manuring alternating with maize, or a modification of such a system.

THIRD SERIES OF CROP ROTATIONS.

In the season 1926-1927 two more rotational systems were laid down, which have been designated Systems M and O respectively.

System M. This is a four-course rotation in which the sequence of the crops is:—Maize plus 200 lbs. per acre of super-phosphate; groundnuts; maize plus 200 lbs. per acre of raw rock phosphate; green manure. Hence one-half of the land is sown to maize each year, one-quarter to groundnuts and the remainder is green manured.

In the following tabulation the yields of the crops are given in bags per acre, a "bag" of maize being 200 lbs. and a "bag" of groundnuts 65 lbs.

Yields of Maize and Groundnuts in Bags per Acre.

Plot	1945-46	1944-45	1943-44	1942-43	1941-42	1926-27	Average 1926-46
A	8.30*	23.00N	17.67*	G.M.	8.69*	G.M.	13.00
B	9.70N	16.91*	G.M.	7.67*	23.50N	15.15	11.82
C	13.94*	G.M.	15.20*	6.80N	11.55*	21.00N	13.38
D	G.M.	14.04*	11.00N	10.23*	G.M.	12.06	11.75
Average Maize ...	10.65	15.48	16.44	8.95	10.12	13.88	12.49

* Denotes the application of fertiliser.
G.M. Denotes the application of green manure.
N Denotes the position of the groundnuts in the rotation.

The yields in this rotation are lower than were expected, in view of the performance of these plots during recent years. They are comparable with those for the season 1941-42, when the various crops occupied the same plots. In that season the rainfall was 26.42 inches, but it was more evenly distributed than during the season under review. It appears, therefore, that the system of cropping and manuring followed in this rotation is maintaining the fertility of the land fairly well, but the amounts of organic matter and phosphatic fertiliser returned to the land represent the minimum required for the maintenance of productivity. On most farms where groundnuts and maize are grown, kraal compost would be available for application to the land, and it is probable that an addition to the supply of humus by such means would considerably increase the crop yields in this rotation.

System O. The order of rotation is:—Maize, fertilised with 200 lbs. per acre of raw rock phosphate; sweet potatoes; maize, which receives a dressing of eight tons per acre of farmyard manure; legume hay. This system is suitable for farmers who prefer to feed a large proportion of their crops to livestock.

In the tabulation below are shown the acre-yields of maize in bags of 200 lbs. and of bean hay and sweet potatoes in tons. Edible canna replaced sweet potatoes in the seasons 1944-45-46.

Seasons and Yields in Bags (or tons) per Acre.

Plot	1945-46	1944-45	1943-44	1942-43	1941-42	1926-27	Average 1926-46
F	8.7†	P 1.1	16.33*	H2.00	11.39†	H 1.10	15.33
G	P2.2	14.8*	H2.4	10.05†	P4.10	19.65†	13.93
H	9.3*	H 2.2	10.41†	P2.38	7.35*	P 6.10	14.79
J	H2.3	12.2†	P2.43	6.95*	H1.40	16.45*	11.72
Average Maize	9.0	13.45	13.37	8.50	9.37	18.05	13.94

* Denotes the application of fertiliser.

† Denotes the application of farmyard manure.

P Denotes the position of the sweet potatoes in the rotation.

H Denotes the position of the hay crop.

The yields obtained in this rotation at the commencement of these trials in the season 1926-27 are seen to be 4 bags of maize per acre more than those of System M. The average yield for the 5 years just past is 1½ bags per acre less here than in System M, showing that the cropping system followed in System O has reduced the productivity of the land very considerably. In this rotation all the crops are removed from the land, and only half as much phosphatic fertiliser is applied. It appears that both the supply of organic matter and phosphate need to be increased to restore the lost fertility or even to maintain productivity at its present level.

These rotational systems have provided very valuable information with reference to the effect of various methods of crop rotation, applications of phosphatic fertilisers and organic material in the form of farmyard manure or as green crops ploughed under. They have shown that although dressings of either organic material or phosphates are followed by increased maize yields for a few years, results which are favourable and permanent cannot be obtained without the use of both phosphatic fertiliser and organic material in some form or other. The amount of phosphatic fertiliser which should be applied will depend on whether the organic matter is supplied in the form of farmyard manure (kraal compost) or green manure. Reference to Systems F and H show that 8 tons of farmyard manure and 200 lbs. 19 per cent. super-phosphate during each 4-year period have checked the decline of fertility somewhat more effectively than one green manure crop and 400 lbs. of phosphatic fertiliser. The unpleasant fact of the gradual decline in the productivity of this land should be carefully noted. With few exceptions there is a downward trend in its ability to yield crops equal to those obtained during the first five years of the trials. Yields of 20 to 25 bags per acre, often obtained 25 years ago, are seldom reached to-day.

It may be added that experiments designed to arrest the declining fertility of this land have been laid down, and the results of these will be reported in due course.

EFFECT OF DIFFERENT INTERVALS BETWEEN APPLICATIONS OF GREEN MANURE.

In the season 1939-1940, experiments were commenced for the purpose of comparing the effect of green manuring at various intervals on the yields of maize crops grown during the intervening years, the object being to enable farmers to decide as to whether the practice of green manuring at frequent intervals is likely to be more profitable than the growing of more crops of maize between green manuring or vice versa. Included in this series of trials are plots on which leguminous crops are grown at various intervals and used as hay or as silage, while on others the legume crop is allowed to mature and the seed is reaped. These trials include plots on which manuring is replaced by a 4-year grass ley, and others in which a 3-year grass ley is supplemented by one green manure crop during each 8-year period.

The following tabulation shows the method of cropping practised in each rotational system over a period of eight years. Each system is employed on eight to ten plots, and the cropping within each group of plots under the same rotation is staggered through the years in order that seasonal climatic effects may be eliminated as far as possible from the final results. For example, System D involves the use of nine plots; each season three of these are green manured, while the remaining six are cropped with maize.

In the tabulation M. equals Maize; G.M. equals Green manure; L.H. equals Legume hay (silage); L.S. equals Legume for Seed; G. equals Grass Ley.

Legume—Maize Rotational Systems.

System Symbol	First Year	Second Year	Third Year	Fourth Year	Fifth Year	Sixth Year	Seventh Year	Eighth Year
A	G.M.	M.	G.M.	M.	G.M.	M.	G.M.	M.
B	L.H.	M.	L.H.	M.	L.H.	M.	L.H.	M.
C	L.S.	M.	L.S.	M.	L.S.	M.	L.S.	M.
D	G.M.	M.	M.	G.M.	M.	M.	G.M.	M.
E	L.H.	M.	M.	L.H.	M.	M.	L.H.	M.
F	L.S.	M.	M.	L.S.	M.	M.	L.S.	M.
G	G.M.	M.	M.	M.	G.M.	M.	M.	M.
H	L.H.	M.	M.	M.	L.H.	M.	M.	M.
J	L.S.	M.	M.	M.	L.S.	M.	M.	M.
K	G.M.	M.	M.	M.	M.	G.M.	M.	M.
L	L.S.	M.	M.	M.	M.	L.S.	M.	M.
M	M.	M.	G.	G.	G.	G.	M.	M.
N	M.	G.	G.	G.	M.	M.	G.M.	M.
O	M.	M.	M.	M.	M.	M.	M.	M.

The lay-out of the experiment provides a single plot for each method of cropping on each block of land. Eight complete blocks of land are used, but additional plots were found necessary in order that the complete cycle of rotation may be practised each year in the case of Methods D, E, F, K and L, and thus avoid a possible bias due to seasonal climatic effects.

Phosphatic fertiliser is applied at the rate of 150 lbs. per acre per annum in all systems excepting those which include grass leys. In the latter systems fertiliser will be applied at the rate of 200 lbs. per acre per annum to the maize crops, but no further applications will be made after the grass has been established. Hence the maize-legume rotations and the 3-year grass ley rotation will receive 1,200 lbs. of phosphatic fertiliser during each 8-year period, but the 4-year grass rotation will receive only 1,000 lbs. The fertiliser is composed of equal parts of raw rock phosphate and super-phosphate.

In the following tabulation the average yield of maize obtained in each system during the past four years is shown. The figures given are the yields per acre of the whole area under each system of cropping. Hence in System A, where green manuring is practised on one-half of the area each season, the yield of the land actually cropped with maize was twice as much as the figures given for that system indicate. The systems which include grass leys are not included, as that method of treatment has not been practised long enough to provide reliable information as to its effect on the maize yields.

Effect of the Legume Crop on the Maize Crop(s) which follow.

System Symbol	No. of maize crops between each legume crop	Use of Legume	Seasons and Maize Yields in Bags per Acre over the whole area, including land under Green Manure				
			1942-43	1943-44	1944-45	1945-46	Total
A	1	G. Manure	7.8	10.0	8.7	7.1	34
B	1	Hay	2.7	8.1	3.8	4.1	19
C	1	Seed	4.1	6.6	4.4	3.7	19
D	2	G. Manure	6.0	9.8	9.1	7.0	32
E	2	Hay	5.2	7.4	5.1	4.7	22
F	2	Seed	4.4	7.8	5.9	3.6	22
G	3	G. Manure	7.1	11.1	8.4	5.8	32
H	3	Hay	3.7	8.4	5.2	3.1	20
J	3	Seed	4.7	8.9	5.4	3.1	22
K	4	G. Manure	5.0	10.4	7.6	5.3	28
L	4	Seed	5.2	10.0	5.9	3.5	25
O	Maize Continuously	—	4.4	11.9	6.9	3.2	26

Velvet beans are used for the legume crop in these trials.

Comparison of the numbers in the last column shows that the effect of ploughing under the whole legume crop for green manure is much more beneficial to the maize crop which follows, than is the effect of the legume crop, which is entirely removed from the land for use either as hay or for seed. When comparing these figures, it should be remembered that in the case of the hay/seed rotations, revenue, in addition to that indicated in the tabulation, would be obtained direct from the legume crop, and for this reason it might be found more profitable to feed the legume to livestock or to sell the seed instead of ploughing it under for green manure. The yields recorded show very definitely that when a crop of legume hay is removed from the land, the quantity of plant food taken away is approximately as great as that used by a crop of maize, so that if such a system is followed for more than a short period, the ultimate effect on the fertility of the soil will be the same as when maize is grown continuously.

These returns show that when the legume is used as hay, steps should be taken to conserve the manure of the animals which eat the hay and to return it to the cultivated land.

It may be added that in these trials in future, in the cropping systems in which the legume is used as hay, applications of two tons of compost per annum will be made. Where the legume is used as seed, the residue of the crop will be returned to the soil.

With regard to the effect of the interval between the applications of green manure, these returns show that the highest average yields of maize are obtained when the land is green manured on alternate years, but that the average is almost as high when two or three crops are grown between the manurial legume crops. By referring to the yields for the 1945-46 season, it is seen that the productivity of the land where green manure is ploughed under at long intervals is declining at a faster rate than where it is used frequently. Comparison of the yields for recent years also show that where maize is grown continuously without a change to a leguminous crop, the fertility of the land is declining more rapidly than that of the other land in spite of liberal applications of phosphatic fertiliser.

Maize: Distance-planting Trials. In a previous trial, the detailed results of which are published in Bulletin No. 830, it was shown that the heaviest yields of maize were obtained when the plants were spaced 30 ins. x 15 ins. to 36 ins. x 18 ins. In other words, yields are likely to be reduced when individual plants occupy less than 450 square inches or more than 648 square inches of the surface of the field. Hence the standard spacing for maize under conditions pertaining in this Colony is accepted as approximately half a square yard to each plant. The scarcity of labour and the necessity for continuing with measures for the destruction of witchweed plants until late in the season has impelled the adoption of spacings of six feet or more between the rows of maize. The question has arisen as to whether yields are likely to be reduced by close planting in rows which are widely spaced, and whether two plants in hills spaced 18 ins. apart will yield as well as when plants

are evenly spaced along the row at 9 ins. apart. Placing two plants per hill at 18 inch intervals is a convenient method of planting on witch-weed infested land, as the wide spacing allows the land in the rows to be weeded more quickly than is possible at the closer spacing of 9 ins.

In the season 1942-43, trials were commenced with the object of comparing the effect on yields of grain when the plants are grown with various measurements between rows and plants in the rows, but when the average space allowed each plant is half a square yard.

The results of these trials are given in the following tabulation.

Spacing and Yields of Maize in Bags (200 lbs.) per Acre.

Season	36″ x 18″ Single Plants	36″ x 36″ Two Plants per Hill	72″ x 9″ Single Plants	72″ x 18″ Two Plants per Hill
1942-43	14.40	13.40	11.20	12.00
1943-44	15.63	15.43	14.25	14.28
1944-45	14.40	14.23	14.97	16.07
1945-46	13.68	13.70	13.87	13.12
Averages	14.53	14.19	13.57	13.87

These results corroborate previous trials by showing that the even distribution of the plants conduces to the highest yields, and that somewhat lower yields are to be expected when the plants are crowded together in rows which are widely spaced. (See Bulletin 895 for report on previous trials.) It will be seen, however, that the yields from the widely spaced rows are only half a bag per acre less than those of the rows spaced 36 inches apart, and so, under field conditions, and particularly when tractors and large implements are employed, the more effectual cultivation and weeding facilitated by the wide spacing might account for a much larger increase in yield than half a bag per acre.

The Effect of Various Manurial Dressings on the Seed Production of—

(1) Maize. (2) Soya Beans. (3) Sunnhemp.

The Manurial dressings are as follows:—

(a) Compost, 8 tons per acre.

(b) Lime, 1 ton per acre.

(c) Raw rock phosphate and super-phosphate mixed, 200 lbs. per acre.

(d) Compost, lime and phosphate.
Amounts as in (a), (b) and (c).

(e) Compost plus lime.
Amounts as in (a) and (b).

(f) Compost plus phosphate.

(g) Lime plus phosphate.
Amounts as in (b) and (c).

(h) No treatment. (Control.)

These dressings were applied in randomised strips at the beginning of the 1944-45 season. Each dressing was replicated ten times, and the three crops were sown across each strip. The maize and soya beans were sown during the early part of December, but the sowing of the sunnhemp was delayed until the last week of that month as a precaution against the attack of beetles, which often cause so much damage to this crop when it is sown earlier in the year.

Prior to the sowing of the 1945-46 crop, further dressings of 200 lbs. per acre of phosphate were applied to all those plots which had received phosphate in the previous season, but no further dressings of compost or lime were made.

The combined yields for two seasons are given in the following tabulation.

Yields in Bags of 200 lbs. per Acre: Totals over Two Seasons.

	Compost only	Lime only	Phosphate only	Compost, Lime and Phosphate	Compost and Lime	Compost and Phosphate	Lime and Phosphate	No Treatment
Maize	20.1	19.0	18.5	22.9	21.1	21.7	18.5	16.7
Soya beans	8.2	8.0	7.7	10.8	10.2	8.9	9.2	6.1
Sunn-hemp	4.4	4.5	4.7	5.7	4.6	4.8	4.8	3.6

The increases due to the various treatments are shown in the following tabulation, which includes increases obtained in the first series of trials in which similar applications of compost, lime and phosphates were made.

Increases due to Manurial Dressings: Bags of 200 lbs. per Acre.

	Compost only	Lime only	Phosphate only	Compost, Lime and Phosphate	Compost and Lime	Compost and Phosphate	Lime and Phosphate	No Treatment
Maize	8.7	5.8	6.3	15.2	12.3	12.1	6.1	—
Soya beans	5.2	4.3	3.1	9.8	9.0	6.7	6.7	—
Sunn-hemp	2.3	1.0	1.3	3.7	2.4	2.4	1.9	—

The plots which received dressings of compost have given larger returns than those dressed either with lime or phosphatic fertiliser, but both lime and phosphate have had beneficial effects. Soya beans have responded more to lime than to phosphate. Although the above trials were laid down to ascertain the effects of the various dressings on the seed production of the crops, they also indicate the effect on the vegetative growth. The growing of legumes for ploughing under to increase the organic matter in the soil is now common practise, and these returns show that the growth of the legume crop depends to a large extent on the amount of humus it finds in the soil, so that in order to obtain best results from green manuring, the humus content of the soil must not be allowed to drop so low that the growth of the green manure crop is adversely affected.

Ground Nut Variety Trials. The climatic conditions were very favourable for this crop during the season under review. The germination of the seed was very good, resulting in almost perfect stands, and the heaviest yields recorded for many years were obtained. The varieties Gold Coast and Masumbika were excluded from these trials, for they have consistently proved less suited to our conditions than the other kinds.

Yields of Nuts-in-Shell in Bags of 65 lbs. per Acre.

	1941-42	1942-43	1943-44	1944-45	1945-46	Average of 7 Seasons
Virginia Bunch	20.8	15.7	28.8	32.2	53.4	29.6
*Valencia	21.2	9.8	30.1	24.0	42.7	23.8
Indian Coromandel	15.5	14.7	31.8	30.3	45.2	26.2

* This variety is locally known as "Spanish Bunch."

In addition to the nuts, a very useful crop of tops was obtained. The yields per acre were: Virginia Bunch, 1½ tons; Indian Coromahdel, 1 1/5 tons; and Valencia, 3/5 ton.

Although Virginia bunch yields heavy crops when it is grown under favourable conditions, farmers should remember that it requires a considerably longer growing season than the Valencia variety, so that, unless it can be sown early in the season, the latter variety may prove to be the most profitable. In the season under review the ground nuts were sown on December 10th.

POTATOES.

Method of Application of Fertiliser Trials. It is usual to apply heavy dressings of fertiliser to the potato crop. Although it may be more convenient to apply it broadcast before opening the furrows to receive the seed, the question arises as to whether it may not be more economical under local conditions to retain a part of the fertiliser for application to the growing plants at a later date.

In the season 1942-43 an experiment was commenced in which all the plots were dressed with 12 tons of kraal compost per acre, and all received 600 lbs. of "Double Complete Potato" fertiliser, which was applied in the following ways:—

(1) 600 lbs. broadcast just prior to the last ploughing.

(2) 600 lbs. in the open furrows before planting the "seed."

(3) 300 lbs. in the furrows before planting, and 300 lbs. broadcast between rows just before ridging the growing plants.

(4) 300 lbs. in the furrows before planting, and 300 lbs. applied in holes "dibbled" in the sides of the ridges in such a way that the fertiliser was placed on a level with, or even lower than, the parent tuber.

The figures given below are the average yields of four plots in the first season, and eight plots in the following seasons.

Yields of Tubers in Bags (150 lbs.) per Acre.

Season	Methods of Applying Fertiliser			
	Whole broadcast	Whole in open furrows	Half in furrow. Half broadcast before ridging	Half in furrows. Half dibbled in after ridging
1942-43	55.0	49.4	62.2	52.0
1943-44	101.0	111.0	116.8	106.8
1944-45	43.4	52.7	52.6	50.9
1945-46	86.4	100.0	96.3	88.8
Averages	71.45	78.27	81.97	74.32

This season's results support those of previous years in showing that heavier yields of potatoes are obtained when the fertiliser is placed close to the plants. It seems to make little difference whether the fertiliser is all placed underneath the tubers before planting or whether a part of it is reserved for application when the plants reach the earthing-up stage. The chief advantage with the latter method is that it allows for the saving of one-half of the fertiliser if, through unforeseen circumstahces, the farmer finds the second application is not likely to be utilised by the crop.

Placing half the fertiliser in the furrows and broadcasting half before ridging gave an increased yield compared to broadcasting all the fertiliser before the last ploughing of 14.72 per cent., or 10.52 bags per acre, worth at current prices about £13 3s.

Soya Beans. Strain trials with these were continued with the strains obtained by cross-breeding a number of Hernon strains with the Potchefstroom No. 184 variety. A number of these yielded more heavily than our standard variety, Hernon No. 107, and after fur-

ther tests next season those which prove to be the best will be available for issue to farmers.

Velvet Bean Hybrids. With a view to getting a strain of velvet beans which will yield as much fodder as Jubilack and produce a larger quantity of seed more consistently, crosses were made between Jubilack and another variety, which, although it produces seed in large quantities, much of its seed is not viable. Several promising strains have been obtained, and these have been grown in trial plots for the past three seasons. During the season under review, the best of these yielded 50 per cent. more growth of stalk and leaf than the Somerset variety, and also somewhat more seed than that well-known variety.

Before the above strains were established, a large number of single plant selections were made within the Jubilack variety. After much testing, the strain No. 74 was found to be the best, and seed of this has been sent to the Gwebi Government Farm for propagation. It is expected that a few bags of this seed will be available for issue to farmers after the 1947 harvest.

Cowpeas. In the season 1938-39, crosses were made between the varieties Turiani and New Era and strains of the upright kind received from Potchefstroom. As a result of this work, many hybrid strains have been isolated and tested during the intervening years. Two of these have proved to be more prolific than the others and they will be propagated for distribution to farmers as soon as our stocks of seed are large enough.

The Hybrid **S.E.S.D.3** is semi-upright and it produces a heavy crop of both fodder and seed. It is more resistant to the various "blights" which attack this crop than are the native and imported varieties. Its seed is small in size. The colour of the seed is pale grey with a purplish tinge when it is first reaped, changing to light brown with a pinkish tinge a few months later.

The Hybrid **S.E.S.G.4** is also semi-upright. It produces heavier crops of fodder than D.3 but somewhat less seed. The combined seed and fodder yield is considerably heavier than that of the other hybrid. It is "blight"-resistant. Although its seed is small in size when it is compared with Turiani and the native kinds, it is somewhat larger than that of D.3 and Dr. Saunders Upright. Its seed colour is similar to the latter variety, namely, dark reddish brown, which gradually turns deeper with age.

Most farmers who grow cowpeas prefer a variety which produces an abundance of fodder rather than one which gives little fodder, even though its production of seed is satisfactory. For this reason it is thought that the G.4 strain will be the most useful to the majority of our farmers. In the trial plots it has yielded considerably heavier crops of both fodder and seed than such varieties as Turiani, Dr. Saunders Upright and New Era. Several of the varieties grown by the natives of this Colony have been included in these trials, but their yields of both fodder and seed have been considerably less than the yields of such hybrids as S.E.S.D.3, S.E.S.G.4, and the varieties Turiani, Dr. Saunders Upright and New Era.

Beans for Dehydration. Three varieties of Garden Beans which were recommended by the Government Horticulturist of the Union of South Africa were grown with the object of comparing the relative suitability of their green pods for dehydration purposes. Their names are Burpee's Stringless, Black Valentine and Refugee Stringless. All the varieties were sown on 21st December, 1945. On 11th February, 1946—that is, 52 days after sowing—Burpee's Stringless and Black Valentine pods were near the stage for dehydration, but the pods of Refugee Stringless were too immature on that date, and did not reach the same stage of development until 19th February, or 60 days after the seed was sown. These trials were conducted in co-operation with the Dehydration Officer, who reports as follows:—

"Experiments were carried on at intervals of two days on all three varieties up till 25th February, when the pods were definitely too mature for successful dehydration. The results of the experiments are tabulated below; the figures are averages.

Variety	Crop Yield lb./acre	Optimum age for Dehydration	Dehydration wastage %	Yield %
Burpee Stringless	2,976	60 days	4.4	10.1
Black Valentine	2,805	60 days	4.3	9.8
Refugee Stringless	3,848	65 days	3.8	11.6

"Remarks: The yield figures are high, and it must be borne in mind that laboratory figures are always higher than those obtained in commercial practice. Further, these beans were processed directly after reaping, whereas the factories have to accept material which may have been hours, even days, in transit, so leading to higher rejection and wastage. Even so, the difference between these percentages, and the average obtained at the factories last year of 5.8 per cent. with "Victory," is far too wide to be due solely to laboratory manipulation as contrasted with factory practice.

"From the table above, Refugee Stringless comes out best, but all give dehydrated products of first-class quality, and in that respect there is nothing to choose between them. They are all preferable to 'Victory' for dehydration purposes."

Sunn Hemp (*Crotalaria juncea*). This crop is highly valued for use as green manure, and, although other crops can be used, there are few, if any, which possess all the favourable characteristics of sunn hemp. Over wide areas of the Colony its cultivation has been rendered almost impossible by the depredations of small beetles which attack the plants in their seedling stages, though they are seldom found on plants more than one foot high. At the request of farmers, who found they were no longer able to rely on sunn hemp, a search has been made for a suitable substitute. In

addition to the beetles mentioned above, other insects attack the seed pods and various diseases join these to reduce the yield of seed. Hence, during recent years, the seed has become scarce and expensive.

The merits of a large number of legumes have been considered, including several species of Sesbanias, Crotalarias and Tephrosias, but none has been found to be nearly as suitable for use as green manure as sunn hemp. The Crotalarias are attacked by the same kinds of beetles and other insects and diseases as sunn hemp. The Sesbanias were fairly promising for a few years, but they also were eventually attacked by beetles, which destroyed the whole crop, and by persisting with their chewing and breeding throughout the season, seemed to be of a more formidable type than those which attack sunn hemp. In addition, it was found that the seed of many species of Sesbania did not germinate freely until it was more than a year old. Although the Tephrosias were free from insect attack, their growth was too slow to permit them to be used as an annual crop for green manure, though they might be found useful when it was intended to allow the land to remain fallow for two or more seasons; in such cases, however, farmers might prefer to grow Dhal, which is edible, or to put down a grass ley.

It appears, therefore, that although we have several fairly good substitutes, we have not yet discovered another crop which is quite as suitable as the sunn hemp and convenient for use for green manure. For this reason attention has been turned to the selection of sunn hemp plants which seem to be disease-resistant and able to yield a large crop of seed with a view to the establishment of strains which have hereditable ability to transmit these desirable qualities to their progeny. Some 400 selections were sown in duplicate plots during the season under review. Several of these produced very satisfactory crops of seed, on stalks over six feet high. They will be grown for a further period to determine whether they are really superior to the common stock.

Maize Breeding. This branch of our work has given most promising results, and during the past few years it has received more attention than any other line of investigation. Trials during the season under review have clarified the position in regard to the hereditable qualities of our older inbred strains and have definitely proved that we have enough inbred lines carrying desirable characteristics to enable us to make hybrid maize which will yield considerably heavier crops than any of the ordinary varieties grown in this part of the Colony. Further work is necessary to obtain inbred strains which themselves give heavier yields, and others which are better adapted for other parts of the Colony than those we have at present. For this reason the inbreeding work has been extended, and during the season under review we had over 400 strains in our trials. Many of these exhibited weaknesses at the end of the season which indicate that they may be excluded from future trials, but a large number still remain, and these will be subjected to purification by inbreeding during future generations.

Some few years back the "N" group of inbred strains exhibited desirable characteristics more definitely than any of the other groups, and numerous strains within this group were segregated.

Forty-two of these were cross-bred with other inbred strains during the season 1944/45, with the object of determining the merits of the various strains within the "N" group. By this means some 215 single hybrid combinations were obtained for trial during the season under review. None of these hybrids yielded significantly lower than the Control. Over 90 per cent. yielded more than 25 per cent. above the common variety and nearly 50 per cent. of the hybrids gave yields ranging between 50 per cent. and 100 per cent. more than ordinary farm maize.

The double hybrid trials contained 114 combinations, and of these 60 per cent. yielded from 25 per cent. to 65 per cent. more than the Control variety.

In addition to these single and double hybrids, our trials included 52 top-crosses, which were obtained by using seed from 20 members of the Seed Maize Association for the "female parents" for crossing with various strains belonging to our "N" group of inbreds. Every one of the top-crosses produced in this way yielded more sound grain than the open-pollinated variety used as Control. The lowest increase was a useful 12 per cent. more than the Control, but as many as 75 per cent. of these top-crosses gave yields ranging between 25 per cent. and 54 per cent. above that of the Control. These results indicate that the grain yield of all the varieties of maize commonly grown in the maize belt could be very considerably increased if first generation top-crossed seed was used for the main crop.

These trials have proved without the least doubt that we have now segregated pure strains of maize which have hereditable fecundity and other desirable characteristics. Of these, the "N" group in particular possess great prepotency for heavy yields of grain. The other groups, though perhaps less potent for grain yield, are suitable for combining with inbreds of the "N" group for the production of double-hybrid seed to use for the commercial crop.

Several farmers responded to this Station's offer made at the beginning of the season of free issues of small amounts of seed of the maize inbred S N 4, to cross with their own variety of maize to produce top-crossed seed. Owing to the inclemency of the weather, a number of these farmers were not able to produce much seed, but others produced over 10 bags of top-crossed seed, i.e., sufficient to sow over 100 acres, from the four pounds of inbred seed supplied from this Station. Although this method of producing seed maize will give good results, it has been recommended as a temporary expedient only. It is considered that the production of double-hybrid seed will be more economical than that of top-crossed seed, because both parents will yield more heavily than the open-pollinated varieties available for making top-crossed seed.

Arrangements are being made to increase our supply of seed of some half a dozen inbred strains with a view to making double-hybrid seed on a fairly large scale for issue to farmers at the earliest possible date. Unless unforeseen circumstances impede progress, farmers will be able to commence sowing their commercial crops with hybrid seed within the next two or three years.

Annual Report of the Irrigation Department, Southern Rhodesia

FOR THE YEAR ENDED 31st DECEMBER, 1946.

INTRODUCTION.

It had been hoped with the cessation of hostilities that during 1946 the Department would have taken a very marked stride forward in its general activities, but unfortunately this has not occurred, although in many respects the results of the year's operations can be considered as very satisfactory.

Staff shortages have retarded work to a great extent, and the position has not been improved either, by the many staff changes which have occurred by the employment in permanent posts of temporary staff of unsuitable calibre.

It was anticipated that mechanical equipment would have been available during the year to permit a large amount of construction by these means. New equipment from overseas has been almost unobtainable, and that purchased ex War Disposals has had certain limitations, mentioned later in this report.

The use of native labour on construction must be reduced to the greatest extent, as the total number of natives able to be recruited daily is very small, and this position will never improve. The results of the non-availability of native labour is dealt with in greater detail elsewhere in this report.

During the year there has been a most marked increase in requests for the engineering services of the Department, and in particular those in connection with water conservation and irrigation, while the Conservation Branch has been overloaded with applications also.

The interest taken in conservation in its widest aspects by the whole of the Colony is exemplified by the fact that there are now no less than 20 declared Intensive Conservation Areas and 34 Investigating Committees dealing with prospective Intensive Conservation Areas. The obvious development next to take place must

be the re-demarcation of road council areas, farmers' association districts, etc., in conformation with the declared Intensive Conservation Areas in order that grouping of conservation areas into regional districts may be achieved. The formation of such regional districts will thus enable long-term planning to be put into effect to determine the most beneficial ways of utilising the natural resources of the Colony.

In the meantime it is essential that this Department should collect, as rapidly as possible, full data on the water resources. Some information has been obtained during the year, but further reconnaissance survey parties are essential for 1947.

Great difficulties have been experienced due to shortages of plant and materials for water supplies, and it is hoped that in 1947 steps will be taken to endeavour to increase exports to the Colony from other countries.

Lack of transport has also resulted in difficulties, and it is considered that until sufficient vehicles are available for all Government Departments, departmental transport pools should be established in all other major departments as is done in this one.

Attention is drawn to the remarks, under General Administration, on the necessity for the institution of a Government school for mechanical plant operators.

Details relating to the activities of the Department during 1946 are set out below under the main headings General, Civil Engineering, Mechanical Engineering, and Soil Conservation.

The writer wishes to pay more than ordinary tribute to the loyal assistance given by all members of the Departmental Staff. Circumstances have been exceptionally difficult, and it is desired to record special appreciation of the long hours worked and loyal services rendered in the face of these difficulties.

PART 1.—GENERAL ADMINISTRATION.

1. **General.** Expenditure controlled or supervised by the Department, excluding supervision of expenditure by private individuals on works constructed by themselves, has resulted in a marked increase over previous years, due principally to the increase in capital of the Irrigation Department Working Account from £46,677 in 1945 to £380,000 in 1946.

A considerable quantity of heavy construction equipment and allied plant and stores have been been purchased or are on order. Unfortunately, certain of the mechanical plant purchased and de-

livered ex War Disposal Stocks, Great Britain, has proved very unsatisfactory, and until spares and fitments become available only four tractor units out of a total of 24 received are now usable.

Expenditure on other items shows a general increase, but serious shortage of labour and transport during the year has prevented the full voted expenditure being spent. Conservation works carried out in the native reserves and native areas have been controlled by the availability of labour, stores and transport, and works in the native purchase areas particularly have suffered due to the impossibility of obtaining labour outside of the reserves.

New installations required for water supplies for Government institutions and townships have received a very serious setback, only about 10 per cent. of the necessary work having been completed. This was solely due to no supplies of piping, pumps and engines being available, and unless strong representations can be made to the controlling authorities for further assistance in the allocation of steel to Southern Rhodesia, the position will be even more serious next year.

The responsibility for the maintenance of Government water supplies was taken over by this Department from the Public Works Department on 1st May, 1946. The changeover caused no serious dislocations, and in general plant has been maintained satisfactorily despite the shortage of equipment. This, however, will not be the case next year unless further supplies of engines, pumps, etc., are forthcoming, as, with the exception of recently installed schemes, the majority require replacements of one sort or another.

Four reconnaissance survey parties have been operating throughout the year, but as a result of resignations, only two parties are likely to be available at the start of the coming dry season. The lack of available information may result in a serious setback to the development of the Colony, but every effort is being made to ensure that up to 12 complete parties are put in the field during 1947.

Expenditure on travelling and transport has shown a 30 per cent. increase over last year, and is the result of the very large increase in the number of visits that have been paid by officers of the Department.

The development of the Matopos National Park was taken over during the year and a five-year policy of construction and development has been planned, but unfortunately insufficient labour and lack of mechanical equipment has seriously held up the development work and only essential maintenance has been able to be carried out.

Expenditure controlled by the Department in 1946, with comparative figures for 1945, is as follows:—

	1946		1945	
	Authorised	Actual	Authorised	Actual
Irrigation Dept. Working Account	£380,000	£313,611	£71,677	£54,683
Irrigation Schemes, Native Reserves	7,200	4,720	2,750	3,571
Water Conservation, Native Reserves	59,700	29,770	29,265	25,493
Water Conservation, Native Areas	41,777	15,241	12,225	13,406
Maintenance Work, Native Reserves and Areas	6,200	4,092	3,800	1,941
Water Conservation, European Areas	33,427	30,326	88,932	45,599
Soil Conservation, European Areas	7,600	3,828	7,375	2,140
Water Supplies, Government Institutes and Townships	72,606	13,380	29,668	19,884
Boreholes and Dams on Crown Lands	14,561	3,030	13,250	2,424
Reconnaissance Surveys	4,250	805	2,000	637
Geophysical Surveys	560	297	800	294
Hydrography	4,562	1,026	1,000	145
Maintenance, Government Water Supplies	11,625	9,537	—	—
Maintenance, C/Works	3,600	2,300	1,400	1,443
Matopos National Park	3,490	1,563	—	—
Loans and Subsidies	5,250	3,808	5,000	2,293
Travelling and Transport	21,268	13,362	12,050	9,703
Other Administrative Items	60,600	51,692	31,545	25,156
Total Expenditures	£738,276	£592,438	£312,737	£208,812

2. **Water Court.** The writer or Assistant Director have served as assessors on three ordinary and one special Water Court, which have investigated 188 cases and occupied a total of 75 days.

This number is a record and reflects a considerable increase in the work of the engineers of the Department on the necessary investigations. The following figures are of interest:—

No. of applications received by the Water Registrar	297
No. of cases dealt with by the Water Court	188
No. of engineer investigations for Court carried out by the Department	188

3. **Natural Resources Board.** The writer, or, in his absence, the Assistant Director, attended the majority of the meetings of the Natural Resources Board. Requests for engineer investigations submitted by the Board have in the majority of cases been completed, but owing to shortages of staff, a number of cases still await investigation.

4. **Staff.** The staff position shows an increase of 50 within the Department last year, but is still some 60 per cent. of the necessary strength. These shortages have been particularly felt in the circles where the lack of engineers has seriously restricted advisory work for farmers, and in the Accounting and Clerical branches which have suffered both from shortages of staff and also from frequent changes in temporary relief staff.

Summary of Staff as at End of 1946.

	Administration	Civil Eng.	Mech. Eng.	Conservation	Totals
On Strength	40*	28	6	34	105
On Establishment	46	59	8	42	155
Percentage on Strength	87%	48%	75%	81%	69%

*Of this figure, 33 per cent. are temporary employees with comparatively short service filling fixed establishment posts.

New Appointments and Resignations.

	Engineers	Tech. Assistants	Soil Conservation	General
New Appointments	11	13	16	46
Resignations	7	3	3	23
Nett Increase	4	10	13	23

The Department, in addition, has on strength 103 skilled and semi-skilled workmen who are employed on daily or monthly rates of pay and include drill foremen, mechanics, plant operators, water bailiffs, pumpmen and dam supervisors.

An analysis of the high rate of resignations received from engineers indicate that the probable causes are threefold:—

(a) The lateness of the decisions to increase Civil Service pay and the unfavourable comparisons of salaries with commercial standards.

(b) Shortages of housing accommodation, particularly affecting married staff.

(c) A general desire for "town" employment.

The Soil Conservation Branch has increased in strength by 50 per cent., and the resultant increase in the number of visits paid has proved most satisfactory. This increase in staff can be considered as fortunate, in view of the rather serious dissatisfaction that was caused as a result of the re-assessment of salaries following the cancellation of contracts before expiration and the inability of the Public Services Board to agree to our recommendation that soil conservation officers be graded as technical officers.

The purchase of mechanical plant on the scale contemplated raises the question of the supply of qualified operators. The policy of utilising Coloured personnel has proved most unsatisfactory, and it has been agreed that only qualified European operators should be used in future. It is essential, therefore, that suitable European personnel is obtained and trained, and it is suggested that a Government training school should be developed as soon as possible to meet requirements of all Departments.

5. **Native Labour.** I wish to record my appreciation of the co-operation received from all members of the Native Affairs Department whose assistance has been called for in their efforts to meet our labour requirements under the most adverse conditions, and would point out that without this co-operation the quantity of work recorded this year would have been even less than it is.

PART 2.—CIVIL ENGINEERING.

1. CIRCLE BRANCHES.

(a) **General.** It has not been possible to open the third circle required at Fort Victoria owing to the lack of offices and residential accommodation, and the functions of this circle have been supervised and operated chiefly from the Bulawayo Office. The provision of offices, etc., at Fort Victoria would result in a saving of expenditure against travelling and subsistence, but, in particular, the lack of this station is resulting in a considerable time being wasted in travelling.

As stated previously, the circles have suffered badly from shortage of engineer staff, but in spite of this and as a result of heavy overtime have carried out visits which total over 70 per cent. in excess of those performed in 1945 with a much lower corresponding percentage increase in staff.

The following gives a summary of visits paid by engineers of all circles, and from these figures can be judged the extent to which work and demand for advice have increased:—

Allocation of Visits.	1946	1945
Private Applicants	777	559
Government Irrigation and Water Conservation Works	213	107
Water Conservation and Irrigation: Native Reserves and Areas	827	364
Water Supplies: Government Institutions and Townships	233	136
Water Supplies: Military, Air Force and Internment Camps	—	8
Hydrography: Administration of the Water Act	—	8
Miscellaneous	126	79
Total Visits Paid	2,176	1,261

Of the 777 visits carried out for private applicants, some 180 of these required detailed reports for the Water Court. This necessitated considerable extra work, and though a number of these visits were carried out in the course of normal advisory work, the majority were paid at the request of the Water Court. This, together with the advice to ex-Service men, has been given priority over other private applicants and has resulted in a partial failure to meet the normal requirements of the established farmer and rancher, which, incidentally, have never been able to be fully met over the last 20 years.

The summary of water conservation and irrigation works investigated for private applicants is given below:—

	1946	1945
Earthen Dams or Weirs	329	197
Large Conservation Works	9	—
Irrigation Schemes	182	98
New Irrigable Areas	7,273 acres	2,945 acres

(b) **Government Water Conservation and Irrigation Schemes: European Areas.** No new major scheme for the development of irrigation and water conservation in European areas was projected this year, but a considerable amount of development work was carried out on existing schemes wherever labour was available.

Works were carried out on:—

Cactus Poort Dam.

Ngesi Dam.

Triangle Sugar Estate.

Rhodes Matopos Estate.

Matopos National Park.

Lower Mazoe Irrigation Scheme.

Umshandige Irrigation Scheme.

Umgusa Irrigation Scheme.

Satisfactory numbers of applications have been received for taking up of land under the Umshandige and Umgusa Irrigation Schemes, but the Lower Mazoe Scheme remains completely undeveloped. It is suggested that the present sub-division of holdings under the Mazoe Scheme should be re-investigated very carefully and the allocation of arable grazing and irrigation areas amended, if possible, to make the holdings more attractive than at present.

(c) **Water Conservation and Irrigation: Native Reserves and Areas.** There has been no marked increase in construction work this year, the limitation having been set up by the availability of labour. The number of engineers' visits paid has, however, reached the record figure of 827, which is no less than 463 more than in 1945. This high figure is the direct result of the adoption of the policy to allocate 50 per cent. of available engineers' time to native affairs. Works have been carried out in those areas in which labour has been available, though in some cases labour was forthcoming but no transport was available. This shortage of transport has hindered progress considerably, with a resultant increase in costs.

In the past years before sufficient data was available as to probable evaporation losses, particularly in Matabeleland, storage works with comparatively shallow depths were constructed. It has, however, been realised in more recent years that greater depths of storages are essential, and this has led to an increasing number of larger structures being built. In certain areas considerable success has been achieved from the construction of a number of small "vlei dams" and general conservation measures in support of the main storage works. A further development that has proved most successful is the construction of numerous "boulder weirs," consisting of loosely packed rock grouted over with cement, constructed across "sand rivers." These weirs are not necessarily water-tight, but they have the effect of impeding the storm flow sufficiently to cause an increase in the water content of the sand held up behind these weirs. They are of simple construction and require no skilled supervision.

Only one new major irrigation scheme has been started, this scheme being the diversion of the Mwarari River in the Sabi Reserve, and when completed will command from 800 to 1,000 acres. Combined with this scheme it is hoped that a road causeway will be constructed that will open up the facilities for the transport of crops throughout the north-eastern portion of the reserve.

In addition to this scheme, extensive work has been carried out throughout the year on the Devuli Irrigation Scheme, which is now nearing completion, and will permit of the irrigation of about 3,000 acres.

The following statistics give an analysis of the work carried out in the native reserves and areas during the past eight years:—

Summary of Total Expenditure.

Year	Native Reserves	Native Areas	Total
1939	£19,240	£3,895	£23,135
1940	11,008	2,485	13,493
1941	14,305	2,955	17,260
1942	18,575	4,042	22,617
1943	10,554	8,289	18,843
1944	17,353	9,399	26,752
1945	30,358	14,053	44,411
1946	34,490	15,241	49,731

(d) **Water Supplies: Government Institutes and Townships.** On water supplies to Government institutes and townships a total of 233 visits were paid by engineers on investigations and supervision of works, the majority being carried out on investigations and advisory work owing to shortage of plant, piping, etc. A total of 57 schemes were investigated and reported on and 38 were installed or partially installed, but the total expenditure represents only about 18 per cent. of the work required.

(e) **Maintenance of Government Water Supplies.** The maintenance of Government water supplies shall normally be the responsibility of the Mechanical Branch, but owing to limitation of staff the work has been dealt with by the circles. Mechanics are now stationed at Salisbury (2), Bulawayo (2), Gwelo, Umtali and Fort Victoria.

(f) **Water Conservation: Crown Lands.** Work has been confined to the Karoi Land Settlement Area, and all available labour operating outside of native reserves in the Northern Circle has been concentrated there, but at any one time this has not exceeded 120 natives, and the resultant volume of work has thus been disappointing. One dam and one set of small weirs have been completed, three sites have been prepared ready for construction by a mechanical unit and preparatory work is in progress on two other sites.

2. HYDROGRAPHIC BRANCH.

(a) **General.** It has at last been possible to open a separate branch to deal principally with the collection and circulation of hydrographic data, and though still handicapped through shortage

of staff, both professional and technical, considerable headway has been achieved, and the branch is well on the way to full operation. Mr. A. C. Selby, Hydrographic Engineer, retired at the end of July and his place has been taken by Mr. H. W. Wallis. I would like to record my appreciation of the valuable work carried out by Mr. Selby, with special reference to his hydrographic report covering a period from 1936 to 1946 which he submitted on his retirement. This report, unsolicited, is extremely valuable and indicates the amount of work which was carried out by him with little or no assistance.

The collection of hydrographic data from both first and second order stations has proved satisfactory on the whole, but great neglect has been displayed by the major City Councils of Salisbury and Bulawayo. The former has supplied satisfactory returns in respect of Cleveland Dam, but the recording of information on Prince Edward Dam has been completely unsatisfactory and unreliable, and is in disregard of the Parliamentary authority under which the dam was built. No records have been received from the Bulawayo City Council, which has, however, now agreed to correlate past records and maintain regular returns.

Station recording information are as follows:—

First Order Stations.—Cleveland Dam, Umshandige Dam, Ngesi Dam, Ngamo Dam, Cactus Poort Dam, Prince Edward Dam, Ncema Dam, Khami Dam and Mtoko Dam.

Second Order Stations.—Dassura and Mazoe Rivers, Umwindsi River, Umshagashi River, Umtali River, Umgusa River, Mnukwe River, Odzani River and Popotekwe River.

Third Order Stations.—Umgusa Dam, Zambesi River and Kafue River.

It is recorded that all data has now been brought up to date on the following rivers:—

Umshagashi, Umwindsi, Makabusi, Umshandige and Umtali.

Gaugings of river flows have shown a large increase over previous years, a total of 85 river gaugings being recorded, together with 114 estimates of river flows submitted by engineers of the Departmental circles taken during the course of their tours.

In addition to these, gauging of river flows of the Zambesi and Kafue Rivers have been regularly measured. These are discussed in further detail.

(b) **Zambesi River.** A total of eight gaugings were made, five at Livingstone above the Victoria Falls and three at Chirundu. In addition to these, special gaugings of daily water levels have been recorded at Livingstone, and these have been regularly taken since 1924, with the exception of the years 1937 to 1941, but this lapse in records has fortunately been rectified by information kindly supplied by the Rhodesia Railways of the river levels at a gauge site some distance downstream. These levels have been correllated, enabling the flows to be fairly accurately recorded over this missing period.

It is of extreme interest to note that gaugings at Livingstone show conclusively that the river is silting up above the Falls. A gauging taken on 6th December, 1946, at the period of estimated minimum flow, gives a low flow of 9,888 cusecs as compared with the previous accepted low flow of 20,000 cusecs for the same gauge level.

These gaugings have an importance when consideration is being given to the possibility of the development of power on the Zambesi.

Records of evaporation on the Zambesi have not been obtained to date, but gauges recently received are being erected and regular records will be kept. These records will in time be of great value in considering evaporation losses on any projected scheme at Kariba Gorge.

(c) **Kafue River.** Gaugings of this river were taken in September, November and December, readings recorded being 1,353, 918 and 860 cusecs respectively.

In view of the possible development of power on Kafue River, these records will prove valuable and regular gaugings will continue to be taken.

(d) **Special Surveys.** In addition to the above, the Zambesi River has been surveyed with the object of ascertaining its suitability for use as a base or port for flying boats. An area of the river two miles long and an average of 550 yards broad was investigated in December at a time when the river was at its lowest level for some years. This survey shows that there is every possibility of this area being suitable for the purpose required as far as depth of water is concerned.

(e) **Water Court Matters.** A record number of applications for Water Rights were received by the Water Registrar, and a total of 139 hydrographic reports on these applications was submitted for guidance of the Water Court. These do not include mining cases.

(f) **Staff.** The staff of the Hydrographic Branch has increased in number during the year but has suffered from personnel resignations and from the fact that the majority of the staff has been newly appointed and has required training.

3. RECONNAISSANCE SURVEY.

(a) **General.** Four reconnaissance survey parties were in operation during the year, though only two were complete. The personnel of these parties was built up of three engineers and two technical assistants, and at the completion of the year resignations had been received from two engineers and one assistant.

The following six surveys were undertaken :—

(b) **West Nicholson Ex-Service Men's Settlement Area.** Results of this investigation showed that the district was unsuitable for construction of minor works suitable for individual farms and only relatively large dam sites were available. Investigations were abandoned temporarily after about 50 per cent. of the area had been covered.

(c) **Umshandige-Shashi River Canal.** Investigations started the previous year into the possible augmentation of flood discharged of the Umshandige Catchment were completed. The location of this route would have involved a canal of some 60 miles in length, which was considered uneconomical, and so abandoned. Further investigations were then carried out into alternative routes, and the results indicated possibilities of being able to tap the parallel river, the Umshagashi.

(d) **Umshandige-Umshagashi River Canal.** This survey as a result of (b) was commenced late in the year and completed mid-December. A practical solution has been obtained involving a length of canal of only 45 miles. This survey has disclosed a further possibility of utilising the Shashi River, but at a higher level, and this further investigation will be continued.

(e) **Popotekwe Irrigation Scheme.** In view of the likely development of this scheme, the irrigable and conservation basin areas were demarcated for the purpose of reservation. This involved a complete re-survey of work done prior to 1939. To date the canals have been relocated and the areas commanded under the scheme are nearly completed. Work continues throughout the rains.

(f) **Hunyani Poort Dam.** In view of the possible construction of this dam it was decided to obtain information regarding the possibilities of irrigable areas that might be commanded. High and low level canals were surveyed and confirmation obtained to the effect that some 3,000 to 4,000 acres could be commanded by a high level canal on both banks within a reasonable distance of the Poort. Insufficient area is commanded by the low level canal.

Investigations are being continued on the proposed dam site for preliminary investigations and preparatory to carrying out exploratory boring and cementation work.

(g) **Mtoko Crown Land (Proposed Land Settlement Areas).** Investigations were completed early in the year, results of which showed the area totally unsuitable for minor conservation works for individual farms and the possibility of underground water supplies proved nil. A number of relatively large and expensive sites were, however, located, but their locations proved unsuitable for the immediate development of this area for settlement.

(h) **Future Works.** With shortage of staff, resignations and the lack of response to recruitment, information required for the development of major conservation schemes is still not available, and the necessity for this investigatory work is again stressed. Every effort should be made to ensure that the required staff is made available to obtain this very necessary information. Schemes requiring immediate investigations are:—

(a) Sabi River Catchment, including the Odzi and other rivers.

(b) Possible irrigation schemes from the Odzi and Sabi Rivers for the development of the lower Sabi area.

(c) Rhodesdale (Ngesi): Irrigable possibilities for land settlement.

(d) Sebakwe Dam: Irrigable possibilities for land settlement and the development of existing agricultural areas.

(e) Umshagashi-Shasha River Canals: Catchment augmentation Scheme for Umshandige Canal.

(f) Matabeleland (West and South): General Conservation.

(g) Popotekwe Irrigation Scheme.

(h) Inyagui River: Development of power possibilities.

(i) Mazoe Catchment.

(j) Tsungwesi I.C.A.

(k) Umwindsi River Catchment: Protection of head waters against urban development.

(l) Native Reserves.

A total of twelve survey parties are required to carry out the above essential investigations.

PART 3.—MECHANICAL ENGINEERING.

1. WATER BORING.

(a) **General.** The Boring Branch has been successful in maintaining a high output of work, despite the difficulties of supplies and transport. The demand for boreholes far exceeds that which can be met by the present staff and machines, which total only 14.

(b) **Staff.** There has been no shortage of drill foremen this year, and an average of 12 drills have been fully in operation throughout the year. Most satisfactory progress has been made in training of new drillers in order that there shall be no hold-up on the arrival of the new drills, which are expected shortly. This policy of training drillers departmentally, though increasing the running costs of existing drills, is considered justifiable and will show beneficial results in the future.

Only one geophysical officer is employed, and consequently the two Boring Inspectors have had to act in a dual capacity, and this does not lead to efficiency in the Branch as a whole. It is essential that the services of at least one further geophysical officer be obtained.

(c) **Operation of Drills.** Costs have been high as a result of the increased cost of stores, and which, for most essential items, are about 80 per cent. higher than pre-war. The lack of departmental workshop facilities, necessitating the continued use of commercial firms for minor repairs, is also partly responsible for the high running costs, and the time for such repairs as were sent out to be completed have increased general operating expenses.

It is hoped to complete the Departmental Servicing Workshops next year with sufficient plant to ensure that the majority of minor maintenance work can be carried out departmentally.

The number of boreholes sunk this year has reached the record figure of 256, as compared with 158 in 1945, the corresponding in-

crease in footage being 8,475 feet. The following table sets out the details and allocation of drills for this year:—

Schedule of Drilling Results.

Detail	Private Applicants	Government Institutions	Lands Department	Native Areas	Totals
Footage	17,157	1,274	5,139	8,097	31,667
No. of Drill Months	74¾	12¼	25¼	30¼	142½
No. of Boreholes	148	15	32	61	256
Average Cost/ft. including Casing	15/9	16/6	17/-	13/8	15/9
Per Cent. Successes	87%	75%	63%	74%	79%

The average cost per foot for all applicants shows an increase of 2d. over the figure of 15s. 7d. in 1945, and is due to substantial increase previously mentioned and also to increased transport charges and cost of trainees.

The gross earnings of all drills is £30,484 18s. 3d., giving nett earnings of £28,569 19s. 5d., after deduction of £1,914 18s. 10d. for rebates on approved unsuccessful boreholes has been made.

The total expenditure, with allowance for depreciation of plant, is £29,285 1s. 2d., which gives a deficit of £715 1s. 9d., an average of only £51 1s. 6d. per drill and represents a deficit of just under 2.4 per cent. of the gross earnings.

The comparison of the number of boreholes sunk over the last six years is of interest, and the following table gives details since 1941:—

Year	Total No. of Boreholes	Total Footage	Average Cost per Foot	Total No. of Failures	Percentage Successes
1941	168	22,368	16/11	34	79.8
1942	195	25,862	14/10	31	84.0
1943	169	23,217	14/7	27	84.0
1944	182	27,782	14/7	43	76.4
1945	158	23,192	15/7	26	83.6
1946	256	31,667	15/9	54	79.0

(d) **Geophysical Surveys.** A total of 450 sites were investigated during the year, of which 386 were approved for boring. Drilling was carried out on 238 of these approved sites, of which 29 proved unsuccessful or with capacities under 200 gallons per hour.

The result of these surveys is well up to standard and represents an average of successes on all approved sites of 88 per cent. Very little survey work was carried out this year for plot holders and private drillers, and the comparative few that were done all proved successful.

It is of interest to note that of eight sites selected by applicants against the advice of the Department, all proved unsuccessful.

A summary of previous years' work since 1941 is given below and is proof that the present geophysical survey methods are most satisfactory:—

1941	82.0%	successes	on	total of	150	boreholes
1942	86.0%	,,	,,	,,	179	,,
1943	88.4%	,,	,,	,,	163	,,
1944	78.5%	,,	,,	,,	145	,,
1945	92.5%	,,	,,	,,	119	,,
1946	88.0%	,,	,,	,,	256	,,
6 Years	85.0%	,,	,,	,,	1,012	,,

2. MECHANICAL EQUIPMENT.

(a) **General Plant Situation.** During the year the tractor unit strength was increased from 5 to 41 units, of which 12 were new tractors of 65 h.p. ex local agents. The remaining 24 machines were purchase ex War Disposals Stocks, Great Britain; 7 are 65 h.p. and 17 are heavier machines required mainly for heavy earth moving work such as for dam construction.

In addition to the increased number of tractors, the pull-grader strength has been altered from 3 terracers to 10 heavy pull-graders, also supplied by local agents. A total of 44 light Millars Burns graders was received from England, but these have unfortunately proved unsuitable to our requirements, and so some serviceable tractors have not been able to be put into the field. Twenty-six light "Rippers" suitable for soil conservation work have been received, but only three have been operated, due to the lack of tractors fitted with power control units.

The following table gives a list of the major items of plant equipment held by the Department:—

Plant held as on 31st December, 1946.

65 h.p. Tractors	24	(HD7-1, TD14-4, D6-19)
85 h.p. Tractors	10	(HD10-4, TD18-3, D7-3)
113 h.p. Tractors	7	(HD14-3, D8-4)
Graders, Heavy	10	
Rippers, Light	23	

Complete Dozers to fit 65 h.p. Tractors	9 (5 unserviceable due lack spares)
Complete Dozers to fit 85 h.p. Tractors	5 (all serviceable)
Complete Dozers to fit 113 h.p. Tractors	nil
Complete P.C.U.'s to fit 65 h.p. Tractors	7 (4 unserviceable due lack spares)
Complete P.C.U.'s to fit 85 h.p. Tractors	2 (all serviceable)
Complete P.C.U.'s to fit 113 h.p. Tractors	nil

It will be noted that the tractors now on hand are of three different makes, but this is not at all desirable, and it is essential that standardisation be adopted in order to reduce to an absolute minimum the types of spare parts to be stocked and to render more simple the training of mechanics and operators and the work of the Stores organisation. The present non-standardised set-up is due to the purchase of plant ex War Stocks, necessitated by the non-availability of tractors ex factory.

(b) **Staff.** A very large over-burden of work has been thrown on the small mechanical and administrative staff by the arrival of machines from Great Britain in a very poor state. The major overhauls required by these machines has deprived operational machines of some of the routine and emergency services they should have received, and in consequence some machines which have gone unserviceable have had to wait their turn for repair instead of receiving immediate attention.

There are clear indications that even under more favourable working conditions the present administrative and mechanical staff is inadequate, and it will be necessary to increase the staff and provide suitable stores accommodation and layout. A Central Stores organisation for the whole service is very desirable.

(c) **Specialist Tools.** Machines purchased from War Disposals arrived without any tools essential to the maintenance of the machines, with the result that a considerable amount of mileage was wasted in the distribution of the limited tools available, with a consequent reduction in operating time and an increase in running costs.

(d) **Transport.** During this year there was a serious shortage of transport and even at the most favourable time there were only four three-ton lorries available for servicing eleven operating units all widely distributed. In addition to this, the heavy transport of this Department has been insufficient and to a degree unsuitable to meet the demands made upon it.

The arrival of two 16-ton transporters ex War Disposal purchases is urgently awaited, and with the suitable replacement of the present transporters this problem will be considerably eased.

(e) **Disposition of Tractor Units.** During the year in all cases but one, each operating unit was in a different intensive conservation area, or widely separated in an area with distances between any two units varying from 20 to 150 miles.

As previously stated, this is uneconomical but cannot be entirely avoided until more units become available and until regional committees have been formed.

(f) **Types of Work Carried Out.** The use of mechanical plant was restricted to land settlement areas, intensive conservation areas and native reserves. In the case of the land settlement areas, a large programme of work was undertaken in order to enable ex-Service farmer settlers to get started this year, and consequently had to be done without the correct plant, with resultant damage to certain machines and increased operating costs.

It would have been desirable to overhaul completely each tractor before putting it in the field, but this was not possible due to lack of spares. In consequence, therefore, capacity operation was practised whenever possible, but in spite of this, numerous breakdowns occurred.

(g) **Makers "Spare Parts" Organisations.** This year has been generally poor for commerce and industry, and overseas manufacturers have had considerable difficulty in despatching full quotas of spares. Complete sets of spares have been requisitioned by the agents to cover our requirements, but unfortunately these requisitions were delayed considerably through our inability to supply the necessary information regarding the machines purchased ex War Stocks.

(h) **Training.** During this year 29 Coloured operators were put under training, of whom 21 were passed as operators and 8 were discharged as unsuitable. This training proved expensive, as no full-time instructor was available, resulting in a longer course than would otherwise have been necessary.

These operators, with few exceptions, have proved unreliable in the field, and late in the year it became obvious that European operators should be employed. It will, however, take some time before it can be put fully into practice.

All mechanics employed are well trained, but some time has had to be allocated to further training on specialist work, the difficulties being increased by the varying makes of machines at present being handled.

(i) **Operating Costs.** A total of 21 tractor units operated 9,816 chargeable hours. With the inclusion of chargeable mileage done during movement, this represents total earnings of £8,500 against an expenditure of £13,000.

The reasons for the loss on operation have already been set out, but may be summarised as follows:—

(i) Unserviceable plant received.

(ii) Non-arrival of fitments such as dozers and power control units.

(iii) Arrival of graders unsuitable to our requirements.

(iv) Non-availability of spare parts.

(v) Non-arrival of suitable heavy transporters.

(vi) Training of operators and mechanics.

PART 4.—SOIL CONSERVATION.

1. **General.** The mileage of ridges, drains, furrows, etc., that has been set out this year is approximately the same as last year, but the number of visits paid on conservation matters has increased above last year's figures by 1,300, the total number of visits this year being 3,353.

The interest displayed in the formation of intensive conservation areas is reflected by the number declared, despite the lack of mechanical equipment, which the majority of committees were led to believe that they would be supplied with.

There is no doubt that the problem of soil conservation is now being effectively dealt with and strides have been made by effective propaganda towards the next stage—that is, the agricultural aspect, which is the obvious follow-on from the mechanical methods of the past.

Although limited by the plant available, the use of mechanical earth-moving machinery has proved successful where it has been available, but considerable experience is still required to balance plant against the type of work called for. This is most forcibly shown by the somewhat disappointing results experienced by the use of "light" plant for stumping where the work had to be carried out to assist ex-Service settlers under the Government Land Settlement Scheme. It is appropriate to draw attention to the fact which would, generally, not appear to be appreciated, that heavy earth-moving equipment can not "finish off" a job, and that there always remains a considerable amount of work for which only hand labour is suitable.

2. **Staff.** Twenty new conservation officers were appointed during the year, bringing the total employed to 33 out of the 1946 establishment of 36. These new appointments resulted in a considerable amount of time being spent on training, but the position can now be described as satisfactory and the Branch, with the further addition of some eight professionally qualified men whom it is hoped to obtain in 1947, will produce a well-balanced team.

3. **Training.** It had been anticipated that a normal refresher course would have been held at the beginning of the year, but it was finally decided to substitute for this an intensive course lasting 14 days which, was attended by all new appointees. To avoid the reduction in the number of officers working in the field, the course was repeated five times, a limited number of new officers attending on each occasion. The results proved most satisfactory.

Other conservation officers underwent a more extensive course, which consisted of periods of about two weeks being spent at Grasslands Experimental Station, Matopos Experimental Station, Umshandige Irrigation Scheme, Mtao Forest Reserve and Gwebi Government Farm.

4. **University Students.** The Soil Conservation Course at the University of Witwatersrand is proving very satisfactory, the total number of Rhodesian ex-Service students now attending having reached the figure of 21. A further 6 students are expected to join the Agricultural Degree Course at the Natal University this coming year. It is worth noting the Rhodesian students have a high reputation (at the Witwatersrand University) for capability and hard work.

5. **Analysis of Work Performed.** The following tables give the details of the work carried out by the Branch. The apparent discrepancy between the increase in number of visits paid, compared with miles of ridges, etc., pegged, is due principally to the large amount of time spent on planning work, together with general administration work, such as inspections for bonuses on maize or wheat and time spent on training.

Works Set Out.

	1946 miles	1945 miles
Contour Ridges	2,312	2,339
Storm Drains	179	163
Contour Drains	46	25
Bench Furrows	21	33
Irrigation Furrows and Beds	47	27
Total Mileage	2,669	2,679

Progress of Work Since 1929.

Year	Mileage of Contour Ridges European	Mileage of Contour Ridges Native	Acreage Protectable European	Acreage Protectable Native
1929-1935	1,063	—	31,890	—
1936-1938	2,470	736	61,800	17,808
1939	1,140	1,623	28,550	37,525
1940	1,060	2,265	26,500	54,458
1941	656	2,200	16,400	47,525
1942	831	1,587	21,300	33,775
1943	1,220	3,000	30,500	64,066
1944	2,662	981 (4 months)	66,550	25,530 (4 months)
1945	2,339	—	58,500	—
1946	2,312	—	57,800	—
Total of	15,753 miles		339,790 acres	

6. **Gulley Control, Nurseries, etc.** It has not been found possible during the year to carry out anything more than a minor amount of gulley control work, due particularly to shortage of native labour and lack of nursery facilities.

It is hoped, however, during 1947 that at least five nurseries will be established and that gulley control work will, in future, increase considerably.

7. **Intensive Conservation Areas.** Of a total of 54 possible areas, 18 have been actually declared and 2 have been gazetted for objections, whilst provisional committees have been framed in respect of the balance of 34 areas. These figures, if compared with those of the previous year, which are 2 areas declared with 20 projected areas in the course of the preliminary stages of formation, indicate clearly the vast strides that conservation has taken. In this connection it is of interest to note that of the 3,353 visits paid on soil conservation advice, 1,196 visits were made with respect to the formation of intensive conservation areas.

Owing to lack of serviceable mechanical equipment and to the priority demands on such as was available by the Land Settlement Board and the Native Affairs Department, it has only been possible to operate units in 7 of the intensive conservation areas. However, a large volume of planning and preparatory work has been carried out in preparation for the time when more mechanical units become available.

With the limitation of mechanical plant, it is very essential that there should be grouping of areas in order that the optimum use of equipment may be obtained. Under the present system of self-contained areas an allocation of one unit per area is not possible, whereas if four or five intensive conservation areas plan together on a long-term policy, the number of units allocated to a group can be made to operate together, working progressively through each area. To effect such a plan it is essential for regional committees to be formed to direct the affairs of four or five intensive conservation areas.

A further matter to be considered very seriously is the readjustment of the boundaries of farmers' associations, food production committees, road councils, etc., in order to obtain conformation with the boundaries of intensive conservation areas or groups of areas.

This is necessitated by (a) the fact that the intensive conservation area boundaries are controlled topographically and are therefore unalterable, and (b) the desirability of very close cooperation, over the same localities, of the several types of bodies just mentioned.

The further development of the regional conservation committees, described above, into bodies to control all local activities should be aimed at.

8. **Use of Mechanical Equipment.** The summary of the year's output of work by mechanical units is given below, the work having been confined to four Land Settlement Board areas, six intensive conservation areas in Mashonaland and one intensive conservation area in Matabeleland.

	Work Completed	Hours Worked	Average Work per Hour	Cost Per Mile to Farmer, without Subsidy Allowance
New Ridges	414 miles	3,371	261 yds./hr.	£6 /2/1 per mile
Rebuilds	217 miles	1,141	341 yds./hr.	£3/19/0 per mile
Dozing	—	981	—	—
Stumping	907 acres	825	1 acre/hr.	£0/13/7 per acre

Satisfactory work has been achieved on all the above operations, with the exception of stumping. Stumping was carried out by dozer only, with the result that a large proportion of stumps were left *in situ*, and, furthermore, an excessive amount of hand labour was required afterwards to clear the lands of both stumps and roots. It is considered essential that a ripper is operated with each dozer in order to cut lateral roots and reduce the necessary hand labour to a minimum. Rippers arrived very late in the year, but certain of the tractors had not been supplied with the necessary power control units to operate them, although those units had been ordered.

9. **Transport and Housing.** The proper distribution of soil conservation officers over the Colony has not been possible owing to lack of transport and to the difficulty of obtaining accommodation, and those problems remain almost insoluble at present, though the position as regards transport improved somewhat towards the end of the year, but is still unsatisfactory.

P. H. HAVILAND,
Director of Irrigation.

Annual Report of the Secretary, Department of Agriculture and Lands.

FOR THE YEAR ENDING 31st DECEMBER, 1946.

(1) GENERAL.

The year under review has not been an easy one for agriculture. The season has not been favourable and record outputs which were contemplated in most agricultural products were not reached.

In addition, farming has had to contend with the prevailing shortage of native labour, materials, implements, fertilisers and, in the case of new enterprises, with an excessive rise in the price of land.

Over the whole field, despite these handicaps, agriculture continues to develop and the standards of production to improve.

The following table taken from the Statistical Bulletin Vol. XIV., No. 23, gives a fair overall picture of the general progress which has been achieved in agriculture in this Colony in the last five years. More detailed statistics appear in the various sectional summaries in this report:—

	Unit.	Date or Period.	1939.	1945.	1946.	1947.
Production.						
Agriculture—						
Total (European)						
Value	£1,000	Jan.-Dec.	3,651	9,700	—	—
Butter—						
Creamery......	1,000 lbs.	Jan.	136	194	155	166
Cheese	1,000 lbs.	Jan.	52	90	110	68
Maize—						
Acreage	1,000 acres	30th June	266	224	234	—
Production	1,000 bags	,,	1,210	1,535	1,454	—
Value......	£1,000	,,	576	1,232	—	—
Tobacco—						
Acreage	1,000 acres	,,	63	82	86	—
Production	1,000 lbs.	,,	23,442	52,014	47,219	—
Value......	£1,000	,,	951	3,284	—	—

	Unit.	Date or Period.	1939.	1945.	1946	1947.
Livestock.						
Cattle—						
European......	1,000's	31st Dec.	756	1,001	—	—
Native	1,000's	,,	1,570	1,912	—	—
Sheep—						
European......	1,000's	,,	68	86	—	—
Native	1,000's	,,	235	243	—	—
Pigs—						
European......	1,000's	,,	23	43	—	—
Native	1,000's	,,	109	91	—	—
Poultry—						
European......	1,000's	,,	263	383	—	—

At the moment, judging by the interest in immigration and the inflow of capital, agriculture in Southern Rhodesia appears to be one of the most attractive smaller fields of investment. This development is not without disadvantages as it has led to what may prove to be considerable inflation in the price of the farmer's capital goods.

(2) SHORTAGE OF STAFF.

This Department has had to contend with a serious shortage of staff which, up to the end of the year under review, could not keep pace with the continued expansion of the industry. The existing staff, technical and clerical, is stretched to the utmost. The time has arrived when, to avoid a breakdown, the programme for agricultural organisation and legislation must be adjusted more to the size of the staff available.

At existing salaries it has not been possible to secure the necessary staff in competition with industry and the demands of the large capital which is now being invested in enterprises connected with agriculture. A particularly serious shortage occurs in the Tobacco Industry where the total professional staff of Tobacco Officers has remained at two men through recent expansion. The shortage extends in a lesser degree to all technical and clerical branches of the Department, though it is most apparent to the public in such fields as engineering, soil conservation and veterinary services, which are in the forefront of public attention.

(3) NATIVE LABOUR.

In common with industry, agriculture has felt the shortage of native labour severely. This shortage is caused by the expansion of farming, particularly tobacco, and is not due to a decrease in

the amount of labour available. The striking increase in the amount of labour employed in agriculture is shown in the following table—

	Mashonaland. 1941.	Mashonaland. 1946.	Matabeleland. 1941.	Matabeleland. 1946.	S. Rhodesia. 1941.	S. Rhodesia. 1946.
Agriculture:						
Native Males ...	85,555	120,643	15,701	21,179	101,259	141,822
Native Females	1,148	7,716	111	551	1,259	8,267

Over the period there is an increase of 40 per cent. in the number of male natives employed and a very large increase in the number of females.

This insufficiency of native labour by present standards is likely to be a permanency as long as the country is prosperous. One solution lies in the better general distribution, utilisation and treatment of the labour available. Agriculturally, the most serious disproportion at present lies in the distribution of available labour between Food Production and Tobacco, which is more profitable and can pay higher wages. The plans for the control of imported labour through the Native Labour Commission, recently appointed, should help in securing better distribution and treatment of labour generally.

Food farmers look on mechanisation as another solution to the present difficulty. Plans have been made by the Government to assist financially in mechanisation. It is intended to establish a special Agricultural Engineering Branch in the Division to give the necessary technical advice, test new machinery and work out methods to adapt it as far as practicable to local requirements. A world shortage of the necessary implements and shipping, are the limiting factors at the moment but, as these are overcome, a considerable degree of mechanisation can be looked for on progressive farms generally.

(4) TOBACCO AND MAIZE.

A change in attitude to these two most important crops has been evident during the year. Tobacco is no longer generally regarded as the exploitive crop as it has been commonly considered in the past. At the moment it is financially the most important agricultural product in the Colony and it is realised that the present prosperity of the Colony is largely bound up with the future of tobacco. Every effort must be made to expand the industry and improve the quality of the product.

At the same time it is now realised that despite seasonal differences, food production is falling behind the industrial expansion of the Colony. Food production must be stepped up to attract industry. In this respect the most serious shortage is maize. The country has had to accept two periods of maize rationing in the past twelve months and future commitments for

the importation of maize will be a heavy burden on the financial and transport facilities of the Colony.

The problem calls for long distance planning. Immediate steps which have been taken are to offer a more attractive price for maize, which for the current crop and the 1947-48 crop will, in effect, amount to 25s. per bag for Gráde A maize, and to organise the better distribution of labour to this important industry in the future.

The production of hybrid maize seed by this Department will be increased next season to the limit of our capacity. The results of the use of this seed have been very promising and should increase production materially from the existing acreage when the seed is available on a commercial scale. Every effort will be made to secure an extension of the industry for the 1947-48 crop.

(5) EXTENSION SERVICE.

A start has been made with the organisation of an extension branch to the Department. Two Extension Officers have been appointed. The organisation of the extension and conservation services into one branch is proposed and this combined body should accelerate tremendously the adoption of sound farming and conservation methods throughout the Colony. An acknowledgement must be made here of the work of the Natural Resources Board in creating a public demand for these services. It is encouraging to note, though a great deal of work lies ahead, that the country is more generally realising the value of its soil and natural resources and the need to preserve them.

(6) INDUSTRIAL SERVICES.

The Department is closely associated with the activities of the Cold Storage Commission, Sugar Industry Board and the Dehydration Industry. Separate reports on these industries are laid on the Table of the House and need not be referred to here. The Cold Storage Commission has established itself as a national industry and now plays a dominant role in the cattle industry. The Sugar and Dehydration Industries are still in the demonstration stage. They both face difficulties until their turnover reaches an economic level. They hold great possibilities in the development of the country and should justify the good work and capital which is now being put into proving them.

VETERINARY SERVICES.

The complete report of the Chief Veterinary Surgeon has been laid on the Table of the House and it is only necessary to refer here to the main features.

African Coast Fever. In the Melsetter area the position has improved materially and general control has been good. The District Veterinary Surgeon, however, sounds a caution against any slackness in dipping as the incidence of the disease decreases. In the vicinity of Chipinga there has been a serious outbreak of the disease attributed to the concealment of deaths over a considerable period. A system of intensive supervision has now been

laid down. The difficulties of close control, however, are great owing to the topography of the country and other causes.

Piroplasmosis and Anaplasmosis (Redwater and Gallsickness). An increase in both these diseases is reported from all five veterinary districts. This increase is probably accounted for by an increase in tick life evident on a number of farms, and is frequently attributed to failure of the arsenical solutions in use for dipping. These complaints, however, seldom come from farms where weekly dipping is carried out throughout the year with an extension to fourteen day intervals in the winter months. There is no definite evidence in the Colony so far to show that these diseases cannot be controlled by regular dipping.

Internal Parasites. These conditions cause a considerable loss to the stockowners all over the country. During the war it was difficult and sometimes impossible to get the necessary drugs for their treatment. It is to be hoped as we return to normal production and drugs are available, more interest will be taken in the treatment of these parasites.

Lumpy Skin Disease. It would appear that two different types of this disease occurred during the year. A very mild form in Matabeleland, Gwelo and Fort Victoria, and a more severe type in Salisbury, Mazoe and Lomagundi. The area of the territory east of Marandellas remained practically free of infection. The disease was widespread at the beginning of the year but died down as in previous years with the commencement of winter, and possibly owing to late rains the spread in November and December in no way compared with that of last year.

Contagious Abortion, Tuberculosis, Mastitis, Epi-Vaginitis and Sterility.—These four diseases and the condition of sterility are being taken together, because to establish a successful dairy industry it is essential that they must all be controlled.

As stated in a previous report the loss from four of these conditions in Great Britain in the year 1938 was estimated at over £17,000,000. It is impossible to estimate what it is in this country, but there is no doubt whatsoever that it is increasing rapidly. Dairy stock have more than doubled their value in the past four years and with the importation of high bred dairy cattle this increase is goihg to be proportionately greater. It is to be regretted that the present strength of the Department is too small to deal properly with these conditions, whilst the instance of some of these diseases is low and there is every possibility of getting them under control, instead of delaying until we are in the position of some of the older countries where the cost of eradication is so great that it can only be undertaken on a very limited scale with little hope of success.

The Veterinary Department continues to be held back by a shortage of professional staff. It has proved impossible, on present scales of pay, to fill the existing vacancies in the professional staff. The position has caused serious concern and is now under review. There is an improvement, however, in the number of younger Learner Animal Health Inspectors coming forward who should, in time, form a sound foundation for the future technical staff.

Veterinary Research. The activities of this Department have largely been confined to routine, which has shown considerable extension during the year. Shortage of staff continues to limit investigational work.

The extremely valuable protective services which this department can give to the public are not always appreciated and the Director of Veterinary Research again stresses the importance of submitting smears in cases of disease. Undiagnosed infectious diseases are a menace not only to the stock of the owner concerned, but to the country as a whole, and the submission of smears for examination should be a routine practice.

Contagious Abortion. A valuable feature of the routine work in the past year has been the adoption, wherever possible, of a policy of testing all native heifers sold by the Cold Storage Commission for breeding purposes. While the test in the circumstances cannot be a perfect safeguard against contagious abortion, nevertheless the fact that cases of active infection in these cattle were detected and the reactors withheld from distribution, greatly decreases a danger of the spread of the disease.

Vaccines. The distribution of vaccines of many types forms one of the most important functions of the laboratory at present and continues to increase.

Lumpy Skin Disease. A natural infection of lumpy skin disease from the adjacent commonage to the non-tabled herd on the Station gave the opportunity for some investigation on the disease. An attempt was made to establish that a flying, blood sucking insect vector is responsible for spreading infection from infected to non-infected animals.

The trials were not conclusive but it is somewhat significant that in stables kept as fly proof as practicable, susceptible cattle only became infected after a longer interval than usual, despite close physical contact with highly infected animals. The question of immunity was investigated and it was shown that a natural attack of the disease does not confer a durable solid immunity against artificial infection. There is as yet no definite evidence available of any animal having had the disease more than once as the result of natural infection, though there is much evidence that this does not occur normally.

FORESTRY.

While the activities in the Department have not been publicised, solid progress is being made. The Forest Service is establishing itself as an important national industry.

The general shortage of native labour has limited the extension of forestry operations during the year, especially on the Eastern Border where the main tree planting operations are carried out.

On the professional side satisfactory arrangements to recruit Forestry Officers seem to have been made, and it is anticipated that the professional staff will be brought up to the immediate strength planned within the next few months.

On the technical side the School of Forestry at Mtao has been an outstanding success. This school was established as a temporary measure during the year with the two-fold object of providing an opening for ex-Servicemen and furnishing this and neighbouring Governments with a number of trained foresters. The results achieved so far reflect great credit on the Forest Service and the students. These men, when their training is completed, should play an important part in the development of forestry in Southern Africa.

The total area of Forest Reserves now stands at 1,292,000 acres and plantations of exotic trees amount to 8,802 acres. The unaudited figures for the year are—expenditure £55,836, revenue £31,357.

Forest Circles. The work is organised into four forest circles—

Eastern Districts Forest Circle.

Midlands Forest Circle.

Mashonaland Forest Circle.

Matabeleland Forest Circle.

A certain amount of work is also carried out in co-operation with the Native Department in the Native Reserves.

Commercial activities in all circles made progress. The first seasoning kiln at Stapleford was completed during the year with the exception of the installation of automatic equipment and the provision of loading facilities. When in full operation, the kiln will ensure a more satisfactory class of timber, as the climatic conditions at Stapleford will not allow air seasoning to proceed below about 15 per cent. moisture, i.e., appreciably more than the average required in the drier parts of the Colony where the sawn product is most used.

A record quantity of timber in the form of poles was disposed of from Mtao during the year, the amount being 118,770 cubic feet as compared with the average of 90,000 cubic feet during the preceding five years.

The output of the Forest Nursery for the first time exceeded £3,000 against an expenditure of £1,193.

RESERVES AND NATIONAL PARKS.

During the year the farms Deka Ranch, of 50,647 acres, and Mahohoma, 6,350 acres, were acquired as part of the Wankie and Robins Game Reserve. They provide valuable frontage along the Deka River. The average number of game seen per square mile varied from 1.4 in February to 9.54 in September. This is a slight drop compared with recent averages and is attributed to the lack of concentration resulting from good water supplies. Considerable road and development work is still necessary in these reserves to open them adequately for tourist traffic.

Since 1935 the Forestry Branch has been responsible for the various activities on the Rhodes Inyanga Estate. The activities on the Estate have now been divided as follows:—

(a) An orchard area managed and financed by the Agricultural and Horticultural Branch.

(b) An area leased to the Wattle Company.

(c) An area managed and financed by the Forestry Branch.

(d) An area for National Park purposes

This arrangement will lead to more intensive development of the Estate and, at the same time, ease the burden on the finances of the Estate. A start has been made with (a) and (b) and the work under (c) and (d) will be proceeded with as soon as possible. It is planned to develop the great potentialities of this area and make it a National Resort worthy of the name of its Founder.

BOTANY AND PLANT PATHOLOGY.

Plant Pathology. During the year 454 specimens were received from which 27 diseases were newly recorded in the Colony. The most important of these was *Xanthomonas solanacearum* which causes a bacterial wilt of tobacco, potatoes and tomatoes. It is possible that more than one strain of pathogen is concerned and inoculation tests are continuing. It is not yet certain whether the same strain of bacterium causes Granville wilt of tobacco. This problem is being investigated.

Field observations and work on crops show that—

Tobacco. The general level of diseases throughout the crop was not unusually high, the most common being brown spot (*Alternaria longipes*), wild fire (*Pseudomonas tabaci*), angular spot (*Pseudomonas angulatum*) and barn rot (*Rhizopus arrhizus*). Where late planting due to poor rains caused congestion in the barns at harvest time and leaf was allowed to become over-ripe on the plants, crops were severely damaged by *Alternaria* leaf spot and the barn spotting stage of frog-eye (*Cercospora nicotianae*). Although only a few samples of leaf affected by barn rot were received, yet this disease was responsible for much loss in the crop as a whole. Evidence was received from several growers that modification of barn and flue construction to induce improved convection and aeration during curing, markedly reduced the incidence of barn rot as judged by unaltered control barns.

Potatoes. No report was received of the recurrence of Irish Blight (*Phytophthora infestans*) although the previously infected farms were kept under close supervision.

Early blight, the incidence of which has increased much in recent years in certain areas where potato cultivation has been intensified, was completely controlled by copper fungicides. The success obtained by the spraying contractors resulted in orders being placed for the treatment of about 1,000 acres. These measures have been advocated for many years, but spraying has never been adopted generally by growers owing to the high cost of equipment and inconvenience of operation at a time of year when all available labour is required for other farm work.

Maize. Owing to the generally dry sowing conditions, fungus diseases were not prevalent, but despite this the amount of infection in seed for the 1946/47 crop was higher than last year. The young 1945/46 crop was characterised by the appearance of

many stunted plants entirely deficient of chlorophyll. This type of chlorosis is frequently associated with drought conditions in the early stages of growth, and as the plants become green after rains have fallen the trouble is presumably nutritional. Affected plants, however, rarely recover completely and are often barren —susceptibility to this type of chlorosis appears to be hereditary because several strains of inbred maize exhibited the character uniformly.

Sugar Cane. An outbreak of smut due to *Ustilago scitaminea* occurred on Triangle Estates and was widespread in the C.O.301 variety when first reported. Investigations showed that this variety is very susceptible in Southern Rhodesia and infection of the recently cut cane is probably facilitated by irrigation water. The varieties C.O. 281 and 290 showed considerable resistance to smut and so far no infection has been observed in the P.O.J. 2725 variety. Recommendations for control have been made, including the complete eradication as soon as possible of the C.O. 301 variety.

No other serious diseases have been observed.

Tobacco. Research investigations were carried out over the wide field of tobacco diseases.

Botany. Herbarium: Considerable progress has been made with the Herbarium. One thousand eight hundred and fourteen determinations were made and many interesting and important specimens added to the Herbarium, which was transferred to a converted army hut early in the year. The improved facilities were reflected in the increased amount of detailed work accomplished. Most of the accumulated material of the past has now been named and jacketed.

Herbarium and literature indices have been brought up to date and a card index of references to every known species of flowering plant recorded from Southern Rhodesia has been completed by Dr. Wild. The library has also received attention and a simplified system of filing reprints put into operation.

Botanic Gardens. What may prove to be an historic step was taken this year when the Salisbury City Council agreed to transfer to the Government the area known as Alexandra Park for development as a National Botanic Garden.

The whole scheme, as approved in principle by the Government, comprises a National Herbarium with attached laboratories of plant pathology and seed analysis, adjacent to botanic gardens containing all possible representatives of the flora of Southern Rhodesia and adjoining territories. The area is 170 acres in extent and rises from level ground through gently undulating slopes to a rocky kopje some 150 feet higher. The whole has been protected since the days of early settlement and is representative of virgin *Brachystegia* savannah.

It is hoped to include Mr. H. B. Christian's unique collection of aloes in a suitable way in this garden.

Noxious Weeds. A conference of officials concerned with the suppression of noxious weeds was held in October, when it was agreed to modify the existing schedule of proclaimed weeds, which is largely based on legislation in force in the Union. It was considered that certain species had not proved to be noxious weeds in Southern Rhodesia, whilst in the case of the Upright Star-bur (*Acanthospermum hispidum* DC.), satisfactory methods of eradication over large areas were unknown and in certain circumstances, such as the prevention of erosion, the weed was regarded in some quarters as beneficial It was agreed that the policy for the future would be to proclaim only such weeds as were noxious and whose eradication could be enforced legally, and that the Burweed, Cocklebur, Upright and Prostrate Star-bur, and Mexican Poppy be de-proclaimed.

At the same conference a sub-committee was appointed to investigate the control of Upright Star-bur by ecological methods, particularly in the native areas. A programme has been drawn up to commence in 1947.

No serious new infections of water hyacinth have been reported, and the weed has been kept under strict control in the Makabusi River, where seedlings continue to appear. The weed is still present in the Prince Edward Dam. Successful destruction of water hyacinth by root-penetrating sprays has been demonstrated.

Poisonous Plants. Dr. Wild has continued his study of species of *Senecio* and has identified, as *S. sceleratus* Schwick, that which occurs commonly in the Eastern Districts and is reputed to be the cause of death of many head of stock annually. It is one of the most poisonous species of the genus. This determination has been confirmed by Miss Verdoorn at the National Herbarium, Pretoria. Details of the work so far accomplished are being prepared for publication at an early date.

Other plants studied are Gifblaar (*Dichapetalum cymosum (Hook) Eyl.*). The common Blue weed of lawns (*Euphorbia inaequilatera* Sond.), and a flowering parasite of tobacco, *Striga orobanchoides* Benth.

POULTRY.

The poultry industry has had a satisfactory year. Generally there has been a high level of activity. Conditions have been favourable for development and the demand of poultry products, eggs and all classes of table poultry, has been well maintained throughout the year. There have been no special problems with which to contend in regard to foodstuffs, and although the supply of building materials has been difficult, temporary expedients have been adopted by the use of the usual building materials available on farms.

The cost of small grains and maize advanced during the year and the retail prices of eggs, as scheduled in Government Notice 274/1946, was automatically adjusted by 1d. per dozen from September, 1946. The maximum contract price of eggs stands at 2s. 6d. per dozen.

The Egg Pool arrangement, as adopted in 1945, was again adopted in 1946 and worked satisfactorily. This arrangement, however, can only be considered a temporary expedient and the aim of the poultry industry is still to secure an Egg Marketing Bill as soon as practicable.

Exports and Imports. Egg exports to adjacent territories amounted to 851,185 eggs, valued at £8,705, for the twelve months ending 31st December, 1946.

To Northern Rhodesia...	421,196 eggs, valued at £4,240
To Bechuanaland	1,152 eggs, valued at £12
To Northern Rhodesia	36 eggs, valued at £2
To Portuguese East Africa... ...	81,540 eggs, valued at £833
To Belgian Congo...	347,260 eggs, valued at £3,618

The exportation of eggs has increased by 244,164 eggs, valued at £2,309 over the previous year. Export to the United Kingdom under the "Food for Britain" scheme has not materialised this year.

Imports. Egg imports were 27,346 eggs, value £266, an increase on last year of 15,022 eggs, value £153. Importations took place from Bechuanaland value £225, the Union of South Africa value £26, Northern Rhodesia value £5, United Kingdom value £10. The eggs supplied from all the above sources other than from Bechuanaland were probably for incubation, the object being to introduce unrelated stock.

Table Poultry. The demand for table poultry was good throughout the year. A feature of the Christmas sales this year was the brisk demand at enhanced prices for all classes of live poultry. There was a greater number of poultry, mainly turkeys, offered for sale than in the previous year. The quality of the stock was better and the prices realised remained satisfactory to producers.

The exports of dead poultry to adjacent markets for the year amounted to 30,523 lbs., valued at £2,592, or 1s. 8.34d. per lb., which shows an increase of 4,110 lbs., value £638, on the previous year. Exports were mainly to Northern Rhodesia, the Union of South Africa, Portuguese East Africa and the Belgian Congo.

Imports were small, 259 lbs., value £32, which shows an increase in value of £4 on last year.

Egg Laying Test. The 27th Annual Egg Laying Test commenced on the 1st March, 1946. The number of entries totalled 265 birds, which had to be reduced to 200 birds, thus filling the accommodation available. This is the first time the accommodation at the Test was filled to capacity since the 12th Test in 1931/32. It was one of the most satisfactory tests held in the Colony, 56 per cent. of the birds entered qualified for registration, the minimum qualification being 200 eggs of standard size in 48 weeks. Rhodesia entrants were at the top of the list in both the Heavy and Light breed team sections.

General interest in poultry is on the increase and the expansion which is anticipated makes it essential to arrive at a permanent basis of organisation to avoid the recurrent periods of over and under production which have upset this industry in the past.

CATTLE INDUSTRY.

Generally speaking the year under review was a reasonably good one for the livestock industry. The main difficulties experienced were somewhat less favourable grazing conditions during the winter months, a shortage of maize at the beginning of the year, and an acute shortage of dairy stock.

European Owned Cattle. The number of European owned cattle continues to increase, and this expansion can be taken to indicate the confidence that producers have in the industry under present conditions. The figures from 1935 to 1945, inclusive, are gven below:—

1935	807,416
1936	753,419
1937	734,770
1938	739,869
1939	755,728
1940	826,268
1941	851,449
1942	879,144
1943	918,538
1944	956,217
1945	1,001,269

Supplies of Slaughter Stock. The demand for slaughter stock has more than kept pace with the expansion of the breeding herds. Below are given the figures illustrating this phenomenon:—

Year	Cattle No.	Calves No.	Total No.
1935	71,472	9,300	80,772
1936	71,387	10,216	81,603
1937	82,300	11,139	93,439
1938	89,625	8,805	98,430
1939	93,289	8,195	101,484
1940	106,430	6,156	112,586
1941	110,855	5,059	115,914
1942	132,230	5,609	137,839
1943	139,318	7,305	146,623
1944	145,181	7,396	152,577
1945	156,570	6,881	163,451
1946 (estimated)	166,900	7,600	174,500

With this large annual increase in demand, it is natural to expect the seasonal shortages which have arisen in the last two years. Better planning and increased storage facilities will help to overcome these shortages in the future. The country is, however, faced with a possible beef shortage in the not distant future if industrial development continues on the present scale.

Prices for Slaughter Stock. Prices for slaughter stock during the past year have been on the same scale as in 1945. The details are given below:—

	Rhod. Best	Imperial	"A" Grade	G.A.Q.	F.A.Q.	Compound	Inferior
January . .	59/0	50/0	45/9	35/0	30/0	25/0	20/0
February .	55/0	47/9	43/6	33/3	28/3	23/3	20/0
March . . .	55/0	44/6	40/9	31/0	26/0	21/0	20/0
April	55/0	44/6	40/9	31/0	26/0	21/0	20/0
May	55/0	44/6	40/9	31/0	26/0	21/0	20/0
June	55/0	46/0	42/3	32/0	27/0	22/0	20/0
July	55/0	47/6	43/9	33/0	28/0	23/0	20/0
August . . .	59/0	49/3	45/6	34/3	29/3	24/3	20/0
September .	59/0	51/0	47/3	36/6	31/6	26/6	20/0
October . .	59/0	51/0	47/3	36/6	31/6	26/6	20/0
November .	59/0	51/0	47/3	36/6	31/6	26/6	20/0
December .	59/0	51/0	47/3	36/6	31/6	26/6	20/0

In the opinion of producers these prices, on the whole satisfactory, have two undesirable features in that there is insufficient encouragement for farmers to stall feed cattle and the out of season prices are too low to encourage feeding and delivery at the end of the year. It has been proposed to revise these prices accordingly in 1947.

Grading of Beef for Local Consumption. The grading of beef was continued in Bulawayo and Salisbury and extended to Gwelo, Gatooma and Umtali during the year. The system of selling beef in two grades only has not proved wholly satisfactory. The spread within grades is too great and it is planned to introduce a third grade shortly.

The retail prices of beef (Meat Prices Order, 1945) appears to have worked satisfactorily.

Disposal of Cattle in Native Reserves. The selling of all native cattle in Native Reserves at "Weight and Grade" sales was continued with success by the Native Department.

The agreement between the Native Department and the Cold Storage Commission under which the Commission is the sole buyer of young breeding stock and young steers continues to operate

satisfactorily. This arrangement is fundamentally sound and one of far-reaching importance for the future of the native, the European farmer and the Colony as a whole.

Fattening of Cattle. The stall feeding of slaughter stock very nearly came to a standstill during the war. Only small numbers were fed for the Bulawayo and Salisbury Shows and the Dawson Competition. The main causes of this rather unfortunate state of affairs were mentioned in my report for 1945. Briefly they

(a) a shortage of maize and maize substitutes;

(b) too small differences between the "stall fed" and "grass fed" grades and between summer and winter prices;

(c) comparatively high prices of feeding stuffs.

While these factors operate it is not likely that there will be any material increase in the number of bullocks fattened.

Breeding Stock. A keen demand for breeding stock was maintained during the year. European bred heifers sold at from £7 to £12 each, which are considered very satisfactory prices. The Cold Storage Commission could not nearly meet the great demand for young native breeding stock. They placed all suitable serviceable heifers and young cows obtained from the Reserves at from £4 to £5 each.

During the year under review shipping conditions became somewhat easier and it is pleasing to report that the following animals were imported from Great Britain and the United States of America:—

Breed.	Bulls.	Heifers.
Shorthorn	2	—
Aberdeen Angus	5	6
Hereford	5	—
Sussex	4	18

Cost of importation amounted to approximately £175 to £190 per animal landed on the buyer's farm. To assist importers the Government, through the Livestock Improvement Scheme, paid grants of up to £200 per bull in approved cases. The exact amount depended on the landed cost and quality of the animal.

Importation from the Union of South Africa under the Livestock Improvement Scheme totalled—

Breed.	Bulls.	Heifers or Cows.
Shorthorn	30	3
Aberdeen Angus	—	—
Galloway	2	—
Hereford	1	—
Sussex	3	—
North Devon	—	—
Afrikander	8	72
Friesland	13	20
Guernsey	3	7
Jersey	8	26
Red Poll	1	—
South Devon	6	—

The increase in the number of Shorthorn bulls imported is significant of confidence in beef.

Grants under the Livestock Improvement Scheme increased from £3,268 in 1945 to £5,600 (estimated) in 1946. The Livestock Improvement Committee and the Rhodesia National Farmers' Union both advocate now the introduction of compulsory bull inspection. Legislation to this end is under consideration.

Dairy Cattle. The dairy cattle industry went through a rather difficult period. At the beginning of the year maize was rationed and owners of high producing herds had difficulty in feeding their cattle properly. Towards the end of the year, i.e., with the beginning of the new season, grazing conditions were not nearly as good as is usually the case at this time of the year. Apart from these difficulties Lumpy Skin Disease seriously affected production in many of the best herds.

Very few new dairymen opened up among established farmers. The main reasons were the shortage of good dairy stock in the Colony and the fact that money was made with much less effort and more easily from other branches of farming such as tobacco, beef cattle, maize and potatoes.

Improvement in the dairy herds of the Colony, however, was maintained and a fair number of good bulls were purchased locally or imported from the Union. It was noticed, as a result of the Dairy Bonus Scheme introduced a few years ago, that better methods of feeding and management are being followed in a number of herds.

PIG INDUSTRY.

General. The year was rather a difficult one for the pig farmer. At the end of 1945 maize was rationed and farmers, under the Emergency Order, were forced for a period to sell all their young pigs as porkers. The object was to economise in maize which was in very short supply in the Colony. This gave the industry a rather serious set-back from which it has not yet recovered. A number of producers depending mainly on purchased feed went out of production altogether. This once more demonstrated forcibly the inadvisability of producing more pigs than the farmer can grow feed for. It is extremely doubtful if production on entirely purchased feeds will be sufficiently remunerative during the next few years to encourage or maintain production under such conditions.

Below are given particulars of the number of pigs in the Colony since 1938.

European and Native Pig Populations.

Year.	European Pigs.	Native Pigs.	Total.
1938	21,031	100,746	121,777
1939	23,124	108,950	132,074
1940	32,610	112,789	145,399
1941	36,038	114,543	150,581
1942	35,139	115,272	150,411
1943	44,336	105,698	150,034
1944	48,528	97,434	145,962
1945	42,767	91,440	134,207

It will be noticed that numbers increased rapidly from 1939 to 1944. At the end of 1945 numbers were down on account of very heavy sales as a result of the maize restrictions. At the end of 1946 a further reduction is expected.

Prices. Due to an increase in the price of maize to the consumer there was also an increase to the producer as from the 13th September, 1946. At the same time the Government war subsidy of ¾d. per lb. live weight was withdrawn.

The following are particulars of minimum prices paid for baconers per lb. live weight during the year:—

	Old Prices.*	New Prices.
A Grade	6¼d.	7d.
B Grade	5¾d.	6½d.
C Grade	5¼d.	6d.

*Including ¾d. per lb. war bonus.

Prices were considered satisfactory by the great majority of producers. Those not satisfied depend mostly on purchased feeds.

Quality. From the table below it will be seen that there has been a serious reduction in the number of baconers sold, but a slight improvement in quality. The heavy selling of underweight baconers at the end of 1945 and the compulsory selling of all young pigs as porkers at the beginning of the year combined with reduced breeding due to feed shortages and high costs of feeding stuffs, account for the reduction in the number of baconers sold.

Grades of Baconers Sold 1.1.46 to 31.12.46.

Year.	Total Baconers	Grade A	Grade B	Grace C	Undergrade
1942	23,447	78.5	13.0	4.0	4.5
1943	25,372	78.3	13.6	4.4	3.8
1944	29,884	72.2	17.0	5.6	5.2
1945	34,449	74.3	15.4	4.1	6.1
1946	21,875	77.0	13.7	2.5	6.8

Carcass Competition. It is pleasing to report that considerably more successful carcass competitions were held at both Salisbury and Bulawayo during 1945. This is definitely encouraging and shows a desire on the part of breeders to get more information on the requirements of the market, on their breeding stock and on their own ability as feeders. The competitions were judged by Mr. J. C. Raath, Animal Husbandry Officer, stationed at the Rhodes Matopo Estate.

SHEEP.

The sheep position remained very much the same. Few new breeders started up, but established producers managed to maintain the standard of their flocks. More farmers are beginning to realise that parasite control is as much a matter of management and feeding as it is of dosing.

A number of producers continued to use cross-bred Dorset Horn x Blackhead Persian rams in their flocks. The progeny, known as "quarter breds," appear to be doing well and are comparatively free from wool. Extensive observations are being made on the success or otherwise of these sheep with the view to deciding to what extent their production should be encouraged.

Slaughter Sheep. There was a remunerative market for good slaughter sheep at slightly higher prices than were being paid the previous year. Good lambs sold at 1s. 3d. per lb. dressed weight.

RESEARCH AND EXPERIMENTAL WORK.

The research and experimental work in progress at the Rhodes Matopo Estate on the improvement of native and European cattle was continued. To expedite results the scope of the work was

enlarged and at present approximately 3,000 head of cattle are in the experiment. Investigations were also continued at the Grasslands Experiment Station at Marandellas.

PASTURE RESEARCH.

The work undertaken by this branch is of fundamental importance and must form the basis of all soil conservation work and planned agriculture in the future. The year under review can best be described as a period of establishment and development. The progress made has been considerable, but in view of the urgency and importance of the work, not sufficiently rapid to be entirely satisfactory. Shortage of staff, materials and labour have been the main stumbling blocks.

The accepted scheme of veld and pasture research for the Colony includes the development of two Central Research Stations, with four or five sub-stations attached to each main station to cover all the major veld types. The Central Station at Matopos will serve Matabeleland and the more arid regions of the Colony, and the Marandellas Station the higher rainfall areas of Mashonaland. These two stations have now been established. One sub-station in Matabeleland on the farm Bongola, ten miles west of Nyamandhlovu, was selected and started in August last. This farm is a well-developed one and typical of the particular sandveld type in the area.

Research. By the end of the year a good start had been made with the research programmes on both the Central Stations. At Matopos where there are two major veld types (the thorn veld and the heavier soil types derived from rocks of the Basement Schist formation and the granite sand-veld), rather more than a thousand acres of each veld type will be used for experimentation. At Marandellas close on a thousand acres has been surveyed and laid out in experiments; some two-thirds of this area is typical msasa sand-veld and the remainder wet vlei land, which forms so important a feature of the granite areas in the Colony receiving a favourable rainfall.

Established Pastures. A keen interest in established pastures is being taken by farmers in most parts of the Colony, and the demand for seed and planting material is increasing rapidly. A great deal of trial work to determine the varieties most suited to the varying conditions as well as the technique of establishment is needed, however, before sound advice can be offered in all cases.

Pasture and fodder plant nurseries are now well established at both Central Stations. At Matopos an old irrigation experimental area was taken over for the purpose, and at Marandellas both vlei land and dry land is being used. Some 200 species and varieties of grasses, clovers and other legumes are now under trial. Many of these are of local origin, but extensive introductions from the Union, East Africa, America, Australia and New Zealand have been made.

Soil Investigations and Nutritional Problems. The programme of work of the Pasture Research Chemist has been concerned chiefly with fertility problems of granite veld land (at Maran-

dellas) and the composition of the pasturage on this station in various stages of growth. Fertiliser trials have been laid down, and include the minor elements which in recent years have been found to play so important a part in the improvement of pastures in many parts of the world. A large number of soil and forage samples have been taken for analysis, reports on which will be published in due course.

IRRIGATION.

The Director of Irrigation reports a satisfactory year, though the operations of the Department were handicapped by lack of staff, equipment and native labour.

The activities of this Department cover a wide field. A full report of these is laid on the table of the House and will not be referred to here. It must, however, be recorded that the work of this Department in the field of soil conservation has received striking tributes from Conservation Officials of other countries who have visited Rhodesia during the past year. The reclamation work in the field has definitely focused the attention of the public on soil conservation.

AGRICULTURE.

Season and Crops. The season was again unfavourable. Planting rains were late and irregularly distributed, and excessive rain fell during January. The seasonal rains closed early and little rain fell after mid-March. A comparatively small percentage of the total acreage under maize was planted early. The season was very similar to the one experienced in the previous year, 1945, and the adverse weather conditions were reflected in a reduced yield of maize.

Despite an increase of 10,205 acres, the total European maize crop was 81,330 bags less than that of the previous season. The total European acreage planted to maize, according to figures supplied by the Government Statistician, was 234,107 acres as compared with 223,902 in the previous year. The total production was 1,454,132 bags, or 6.21 bags per acre as against 1,535,471 bags, or 6.86 bags per acre in 1944/45.

The Mazoe District produced the highest yield per acre with a yield of 7.8 bags per acre, production being 431,634 bags; Salisbury and Hartley both averaged 7.4 bags per acre, production being 320,604 and 220,998 bags respectively; Lomagundi 148,204 or 6.5 bags per acre.

The quantity of maize retained on European farms shows the disposal of the maize crop, the total being 650,051 bags as compared with 690,000 bags in 1944/45, 709,000 bags in 1943/44, and 713,000 bags in 1942/43.

Maintenance of Soil Fertility and Rotation Cropping. The total acreage under all summer crops was 534,675 acres as compared with 524,702 acres in the previous year. A very notable feature in the Colony's agriculture throughout the year has been the acreage planted to green manure crops, legumes for hay and the conversion of farm wastes into compost. The acreage under

green manure crops, trap crops for witchweed control and green manuring was 96,449 acres, and legumes grown for hay 70,140 acres, a total of 166,639 acres. In addition to this acreage a further quantity of 369,069 tons of compost was made in the previous year for application to 37,000 acres of crops, at the rate of 10 tons per acre.

The above total of 203,639 acres under legumes or composted represents 38 per cent. of the total acreage planted to maize and all the other summer crops, which can be considered to be a very satisfactory proportion.

Soil conservation also featured very prominently in the sound farming practices adopted in Southern Rhodesia, and it further reflects great credit on the farmers concerned to record that by September, 1945, 309,000 acres of arable land or 59 per cent. of the total area under summer crops were protected by contour ridges and storm drains.

The frequency of green manuring and the use of compost for maize is receiving greater attention by a larger number of farmers. The making of compost is now a routine farm practice. Several maize growers are adopting the practice of alternating maize and green manure as an economical means of increasing maize yields and thereby reducing the cost per bag.

Maize and Wheat Bonus Schemes. The maize and wheat bonus schemes continue to operate successfully and have unquestionably served in many aspects to improve the methods under which the staple crops of maize and wheat in the Colony are grown. The extent of these schemes is indicated in the table below:—

FIGURES RELATIVE TO MAIZE BONUS.

Crop Year 1945-46.

Total number of applications	580
Total number qualified	417
Number qualified 100%	392 (94%)
Number qualified under 100%...	25 (6%)
Declared acreage under maize	112,950
Declared acreage green-manured	65,700
Declared tons of compost made	73,350
Number of bags Pooled	716,018
Bonus Paid	£71,601 17 6

FIGURES RELATIVE TO WHEAT BONUS.

Crop Year 1945.

Total number of applications	106
Total number qualified	85
Number qualified 100%	71.84%
Number qualified under 100%...	14.16%
Declared acreage under wheat	7,488
Declared acreage green-manured	5,792
Declared tons of compost	9,834
Number of bags delivered	25,682
Bonus Paid	£3,711 12 5

Further developments in the system of bonus payments are contemplated and it has been proposed that the method of payment be modified in future to take account of the area planted to legume crops and tonnage of compost produced, as well as the yield of maize, so as to bring into the scheme farmers who do not grow maize for sale as such.

Witchweed Demonstration Farm. The Witchweed Demontration Farm, having served its purpose, was closed down during the year. The project has given a valuable demonstration of the practicability of clearing a farm of witchweed when proper cultural methods are adopted. Full reports of the project have been published in the "Rhodesia Agricultural Journal" and reprinted as bulletins.

Certified Maize and Wheat Seed. The inspection of certified seed was continued. The demand for this seed exceeds the supply and the service has proved its value.

Experiment and Demonstration Stations. There are a number of Demonstration and Experiment Stations under the control of the Agricultural Branch. They will be referred to only brieflly in this report.

(a) **Agricultural Experiment Station, Salisbury.** Maize breeding and the production of hybrid seed has been the most important work here. This branch of the work of this Station has given most valuable results, and it now receives more attention than any other. This season's trials have clarified the position in regard to the older series of inbreds and have definitely proved that we have enough inbred lines to enable us to make hybrid maize which will yield considerably heavier crops than the varieties which have been commonly grown in the past.

These breeding trials indicate that hybrid seed should increase materially the yield of maize per acre and therefore help in reducing the cost of production of this crop. It is proposed to extend the production of this seed very considerably in the coming season and plans have been made for large-scale production of seed at one or more of the Experiment Stations.

(b) **Government Farm, Gwebi.** This farm is at present maintained for crop experiments to demonstrate farming systems and for general training purposes. Considerable development on the farm has occurred during 1946. Refresher courses have been given to conservation officers. Ex-Servicemen trainees have been given practical instruction and at the end of the year five of these men were in residence. During the year regular demonstrations were given at the Gwebi Farm to ex-Servicemen taking the short courses at Mount Hampden.

(c) **Plant Breeding Station, Hillside.** The agricultural operations on the Plant Breeding Station, Hillside, were closed down at the end of November, 1946, and the Station was transferred to the Tobacco Research Board.

The work previously carried out at Hillside is being transferred to the Matopo and Umgusa Stations near Bulawayo. Conditions there are more typical of the areas to be served and it

is proposed to expand the work. An additional advantage of the change is that an Agricultural Officer will now be stationed permanently in Matabeleland.

An interesting feature confirmed by the work at Hillside is the effect of the conditions of growth on the milling quality of the wheat. Samples were sent to the Chemist, Rhodesian Milling and Manufacturing Co., Ltd., Bulawayo, for analysis and baking tests. Wheats grown on the Plant Breeding Station proved far superior to the same varieties grown under ordinary farming conditions. This shows that the Colony can produce wheats of the highest quality when grown under proper conditions of fertility and moisture. The adequate supply of nitrogen is most important to obtain high yields and good milling and baking wheat. Results of analysis and baking trials by P. Fuller were published in the "Rhodesia Agricultural Journal" and reprinted as Bulletins Nos. 1317 and 1356 in the July/August, 1946, issue, Volume XLII., No. 4.

(d) **Umshandige Demonstration Farm.** This farm serves as a demonstration farm under irrigation conditions for the area concerned and as a training centre for ex-Servicemen under the Umshandige Scheme. Steady progress has been made.

HORTICULTURE.

A Horticulturist was appointed during the year. As the position of Horticulturist had been vacant for several months, some difficulty was experienced in recommencing the horticultural work with the scant information available to follow up the previous policy and duties of this Section of the Division of Agriculture.

Horticulturally, Southern Rhodesia is expanding fairly rapidly, and amongst the new settlers are several who have commenced intensive cultivation on smaller farms of limited acreages. It is felt that when these growers get well into production, better quality products will result from this specialisation and good markets should be assured if regular attention is paid to maintaining first-class quality plus good distribution, attractive packing and presentation to the buyers.

Fruit Crops. The citrus crop has been good and sold well. A fair quantity of out-of-season fruits were produced and found ready markets. Crops of deciduous fruit have been fair, with prices good, averaging 15s. per bushel case.

Vegetables. Fresh vegetables have been scarce at times with consequent higher prices, due in part to the cold winter and to the lack of early rains. Continued large quantities have been imported from the Union and marketed in Bulawayo, which at times embarrassed local growers.

Umtali Sub-Station. The water supply on the Station has been improved and the area under trees has been extended. Very useful data is being obtained from the variety trials in progress.

LANDS.

During the year the number of farms alienated reached a record high figure, and from this it will be readily understood that

the members of the Land Settlement Board and the staff of the Department were working at high pressure throughout the period under review. Details concerning the alienations are given in Appendix "A," from which it will be seen that 150 farms have been alienated to settlers under the ex-Servicemen's Settlement Scheme No. 1; and 28 to ex-Servicemen under the Act, i.e., to those who were not eligible for inclusion or did not wish to participate in the Settlement Scheme. In addition to this total of 178 the alienation of a further 61 farms has been approved of by the Land Settlement Board, but not yet finalised.

Appendix "A."

ALIENATIONS.

(a) Ex-Servicemen's Settlement Scheme No. 1.

District.	No. of Farms.	Area Morgen	Sq. Rds.	No. of Grantees.
Bulawayo	2	168	approx.	2
Charter	2	3,000	approx.	2
Gwelo	1	2,045	6	1
Hartley	27	47,520	approx.	27
Lomagundi	57	84,322	approx.	52
Makoni	3	5,961	approx.	3
Marandellas	8	10,362	approx.	8
Matobo	3	5,913	12	2
Mazoe	3	2,746	approx.	3
Mrewa	28	47,172	approx.	27
Mtoko	3	4,767	226	3
Salisbury	1	95	approx.	1
Umtali	4	3,379	92	4
Victoria	8	8,469	approx.	8
Total	150	225,920	approx.	143

(b) Land Settlement Act of 1944: Ex-Servicemen.

District.	No. of Farms.	Area in Morgen.	No. of Grantees.	Annual Rental.		
Bubi...	5	2,953	2	£50	11	5
Charter...	1	1,454	1	25	15	8
Gutu...	1	632	1	8	0	5
Hartley...	5	10,702	5	201	3	5
Inyanga	2	3,659	2	48	0	0
Insiza	2	5,888	2	80	10	8
Lomagundi	8	9,334	5	147	9	3
Marandellas	1	505	1	11	2	8
Mtoko	1	1,432	1	22	18	1
Salisbury	2	1,549	2	45	13	6
Total	28	38,108	23	£641	5	1

The work of settlement has been rendered more difficult by the continued rise in the price of private land during the year. Land in many cases has reached values which are, as far as can be judged at present, uneconomic from the standpoint of general farming. There has therefore been a strong demand that available supplies of Crown land should be thrown open for alienation. The question is under consideration, but it must be emphasised that the area of such land that could be made available is small, if adequate reservation is made for demands still to be met for ex-Servicemen settlers, and is likely to have little effect on the general situation.

This Department, like the rest of the Division, is short of field staff and has been fully extended during the year. The Land Settlement Scheme has proved a great deal more successful so far than was commonly anticipated. The results achieved are in large measure due to sterling work done by the Department in co-operation with a keen and practical Land Settlement Board.

ENTOMOLOGY.

No reports on the presence of any stage of Red Locust have been received and the Colony appears to have been entirely free of this gregarious pest for two years.

Work on insect pests of agricultural crops, including tobacco, has been widespread, but no severe outbreaks are reported.

Tsetse fly operations continue to be the most important line of work of this branch and in all the Northern areas steady progress has been made. Fly densities have been further reduced over the area covered by game elimination operations and additional protection given to areas already cleared.

The threat of invasion of the Mtoko district by tsetse spreading from Portuguese East Africa has increased and early defensive action may soon become necessary. The position on the Eastern Border (Chipinga) shows a steady and progressive improvement, the number of cases of animal trypanosomiasis which occurred being fewer than in previous years.

On the Eastern Border in the low veld south of Chikore, the position has steadily deteriorated and heavy losses of stock occurred. The density of fly in Portuguese East Africa has increased rapidly and dense fly can now be found within one mile of the border in the vicinity of the Honde River. The few head of cattle remaining alive at Mahenya's and in the Honde Dip Tank area have been removed to the Sabi River.

An increase in human trypanosomiasis has been recorded from the Zambesi Valley in the Urungwe district. Thirteen native cases were diagnosed, the highest for many years.

Plant regulatory and pest prevention regulations were administered as usual during the year. The numbers of consignments and packages of plants, fruit, etc., examined at the ports

of entry were as follows, the figures in parentheses being those for 1945:—

	Packages.	Consignments.
Salisbury	99,409 (140,955)	6,150 (6,110)
Bulawayo	239,851 (242,624)	11,507 (11,010)
Umtali	20,580 (16,099)	3,814 (4,035)
Gwelo	1,573 (3,138)	490 (742)
Plumtree...	2,021 (2,228)	148 (170)
Beitbridge	219 (186)	19 (20)
Total...	363,653 (405,230)	22,128 (22,087)

A considerable amount of material had to be returned or destroyed according to circumstances.

Though a useful check was maintained, all the necessary inspections of tobacco premises could not be carried out on account of lack of staff and transport.

DAIRYING.

The dairying season 1945/46 was a disappointing one. The season opened in promising fashion with useful rains in November and December which were followed by exceptionally heavy rains in January and the early part of February; after this, however, the rains practically ceased except for some showers towards the end of March. Although, therefore, the total rainfall was slightly above normal the season was a short one and early anticipations of a greatly increased production of all forms of dairy produce were not fulfilled. Other factors which also affected production were the occurrence of lumpy skin disease in a number of dairy herds, as well as the rationing of maize for stock feeding during the early part of the season.

Production of Dairy Produce. Exact figures are not yet available to show the total quantity of milk handled by the fresh milk trade, but there is little doubt that it fell below the output of the previous year. The production of creamery butter was less than that of the previous season, whilst manufacturers of cheese showed a very slight increase. On the whole, therefore, it is estimated that the total production of dairy produce—milk, butter, cheese and ice-cream—was rather less than that of the preceding dairying season. The production figures are as follows:—

Butter: (Creamery Butter Only).

	lbs.
1942/43	1,229,455
1943/44	1,248,491
1944/45	1,237,166
1945/46	1,081,256

Cheese: (Farm and Factory).

	lbs.
1942/43	536,379
1943/44	529,137
1944/45	679,073
1945/46	680,792

The relationship between production and consumption in the dairy industry is shown by the following figures:—

Creamery Butter.

Year.	Consumption. lbs.	Production. lbs.	Shortfall. lbs.
1941/42	2,251,925 (unrationed)	1,211,267	1,040,658
1942/43	1,844,025 (rationed)	1,229,455	614,570
1943/44	1,609,602 (rationed)	1,248,491	360,571
1944/45	1,300,024 (rationed)	1,237,166	62,858
1945/46	1,613,803 (rationed 4oz.)	1,081,256	532,347

It is estimated from these figures that the unrationed consumption of creamery butter in the Colony would amount to approximately 2½ million pounds per annum which is very nearly 1,500,000 lbs. in excess of our current production. It is unlikely that the industry will be able to make up this shortfall for some years to come.

The total quantity of first-grade butter manufactured during the season was the same as that of the previous year. The figures are as follows:—

Year.	First Grade.	Second Grade.	Third and Below Grade.
1941/42...	65.6	19.4	15.0
1942/43...	75.9	16.3	7.8
1943/44...	72.1	18.1	9.8
1944/45...	78.3	14.0	7.7
1945/46...	78.2	14.8	7.0

All imported butter as well as the bulk of local manufactures were graded before sale. Degradings were negligible. Numerous small consignments of farm butter were also graded.

Farm Butter. The licensing restrictions on the manufacture of farm butter—as relaxed in 1943—continued in force. The number of licences issued during the year amounted to 93 as compared with 106 the season before; three new licences were issued. No applications for licences were rejected.

The quantity of farm butter sold by licensed butter makers amounted, according to their returns, to 40,044 lbs. as compared with 48,877 lbs. the previous year.

Cheese. Production during the year constituted a record. Exports to all markets amounted to 211,118 lbs. compared with 75,039 lbs. the previous year; of this quantity 124,529 lbs. was sent to the United Kingdom as a free gift from the Colony under the "Food for Britain" scheme. The balance was exported to Northern Rhodesia, Nyasaland and Portuguese East Africa.

Imports were negligible and only amounted to 11,410 lbs.

Due to increased exports, supplies for the local market were greatly curtailed and consumption only amounted to 504,437 lbs. as against 600,000 lbs. the year before. The potential local consumption is estimated to be 800,000 lbs. per annum.

The quality of the cheese manufactured was of a very useful standard although not quite as good as that of the previous season.

The grade of this cheese was:—

Year.	First Grade.	Second Grade.	Third and Below Grade.
1941/42...	67.0	21.8	4.6
1942/43...	89.0	9.5	1.4
1943/44...	76.9	20.0	3.1
1944/45...	89.4	8.8	1.8
1945/46...	84.2	14.8	1.0

Milk and Cream. Despite an unfavourable season supplies of milk for the fresh milk trade were well maintained although milk was in short supply in both Salisbury and Bulawayo for a short period towards the end of the year.

The conditions under which milk and cream are produced on the farms continue to show improvement although progress in this direction during the last year has been very slow due to a variety of reasons such as a shortage of cement and building materials generally, lack of dairy plant and equipment, and in some instances a very definite shortage of labour.

Prices of Dairy Products. The prices of dairy products were advanced at the end of the year.

Butter Fat. First Grade 1s. 8d. to 2s. 5d. per lb. raised to 2s. to 2s. 10d. per lb., to which cream suppliers, particularly in the Dairy Bonus Scheme, received an extra 4d. per lb.

Cheese. Wholesale prices for Cheddar and Gouda cheese ranged from 1s. 4d. to 1s. 5d. per lb. and retail prices from 1s. 7d. and 1s. 9d. to 1s. 8d. and 1s. 10d. respectively for cash and credit sales. In addition the Government paid a subsidy of 2d. per lb.

on First and Second Grade Cheddar and Gouda so that the actual wholesale return for first-grade Cheddar was 1s. 6d. per lb. As in the case of butter, however, a new price structure was introduced right at the end of the season whereby the 2d. subsidy was discontinued and the wholesale and retail prices raised respectively to 1s. 8d. and 2s. per lb., the existing margin between cash and credit retail sales being abolished at the same time. On the basis of these new prices, milk made into cheese should now be worth at least 1s. per gallon in addition to which participants in the Dairy Bonus Scheme receive a further 1d. per gallon.

Whole Milk. Prices at Salisbury and Bulawayo remained at the same levels as last year, ie., 3d. and 4d. per pint respectively for cash and credit sales except for a period of three months early in the season when milk prices in all the larger towns in the Colony were increased by ¼d. per pint for cash and ½d. per pint for credit sales as compensation for the reduction in yield caused by maize rationig.

Prices at Gwelo and Umtali were raised to the same level as Salisbury and Bulawayo half-way through the year. As with butter and cheese, new prices were introduced right at the end of the season following on the increase in the price of maize. Under this arrangement the price of milk in quantities of one gallon or more was raised to a flat rate of 2s. 4d. per gallon whilst retail prices were increased by ½d. per pint.

From these prices, therefore, it is fairly evident that the dairy industry will be hard put to maintain production at the present level during the next few years. It is difficult to reconcile this somewhat depressing outlook with the contention that the industry is making progress, but it is nevertheless a fact that the dairying industry has made considerable headway in some directions during the past few years.

During the past few years dairying has had great difficulty in holding its own in competition with other more remunerative and less arduous forms of farming and it is feared that this state of affairs will continue as long as tobacco prices remain at the present high level and labour is difficult to obtain. Within the past three years quite a number of producers have switched from dairying to other forms of agricultural production such as beef and tobacco, but as against this, quite a few newcomers have entered the dairy industry. The effect of the entrance of these newcomers to the industry will, however, not be felt for some time to come, and it is unlikely therefore that production will show any sudden increase on this account.

The industry is now in the process of discarding the old primitive unhygienic practices of the past for the more up-to-date and efficent methods of the present, but this transition will take many years to effect and it seems doubtful whether there will be any appreciable increase in production during the process. Once the change is complete, however, the industry should be able to produce more than sufficient dairy produce for all requirements. Certain factors are definitely assisting in this progress. They are—

(a) **Milk Recording Scheme.** Progress continues to be made in the treatment of dairy stock and the provision of winter feeding

of young growing stock and milking cows. Dairymen are gradually realising that it is essential to have special reserves in the form of silage, etc., over and above the normal annual requirements.

The scheme is expanding, as is shown by the following figures:—

Year	No. of Herds Tested	No. of Cows Tested
1943	59	4,034
1944	110	5,380
1945	130	7,000
1946	153	8,407

Herd Averages.

Year	No. of Cows	Milk lb. per Cow	% B.-Fat	Lb. B.-Fat per Cow	Days
1941-42	1,811	5,621	3.65	204	280
1942-43	1,829	6,161	3.67	226	285
1943-44	2,462	6,252	3.71	232	283
1944-45	3,532	6,050	3.66	221	278
1945-46	4,389	5,768	3.69	213	280

(b) **Dairy Bonus Scheme.** The second year of the Dairy Bonus Scheme ended on the 30th September, 1946. The number of producers participating in the Scheme was 123, as against 100 the year before; of this number, 5 failed to qualify for the bonus. The remaining 118 producers received collectively a sum of over £6,000, representing the bonus on 434,172 gallons of milk made into cheese and 261,937 lbs. of butterfat delivered to the creameries. This represents close on 29 per cent. of the total butterfat supplied to the creameries and 58 per cent. of the total milk made into cheese. The average bonus received was £55, although individual bonuses in some cases amounted to £200.

The Scheme has unquestionably brought about a considerable improvement in the conditions and methods of production on the farms of the participating dairymen and there is no doubt that if the Scheme continues long enough it will have the effect of placing dairying on a much-improved basis.

National Milk Scheme. A National Milk Scheme is still under consideration. The supply of milk to most centres in the Colony is not satisfactory, and a Scheme of this nature appears necessary to ensure the distribution of hygienic milk at reasonable prices to the consumer. Both the producer and consumer should benefit from an organisation of this kind, and developments in the past year seem

to have brought the establishment of a National Scheme appreciably nearer.

CHEMISTRY.

Owing to the large increase in the number of samples submitted to the branch for analysis, the main activity of all the officers of the branch, with the exception of those entirely engaged on special services, such as pasture research and dehydration, has been the accomplishment of the more or less routine analytical work.

The officers engaged in routine analytical work also carry out a considerable amount of advisory work, both by correspondence and interview, mainly in connection with the reports on the results of the analyses of the samples submitted.

The opening up of new areas of land settlement and the establishment of new irrigation schemes is making a progressively increased demand for advice on soil problems and the manurial treatment of soils, and it is in this direction that the work of the branch has shown the greatest increase during the past year.

Fertilisers. Although fertiliser supplies were somewhat better, the year was a very difficult one from the control point of view, as the demand for nearly all types of fertiliser was greater than in any previous year in the history of the Colony.

In spite of controls, temporary shortages, largely due to transport difficulties delaying the arrival of superphosphate from the Union of South Africa, caused some dislocation in the arrangements of tobacco and maize growers, as they were not always able to get delivery of their fertiliser at the required period. This has meant that in a few cases growers could not take up their full allocations as, owing to labour shortages, they were not able to apply fertiliser at the required period.

The supply position with respect to nitrogenous and potassic fertilisers, although somewhat improved, is, owing to increased demand, still very difficult, and it seems probable that fertiliser distribution will have to be controlled for the 1947-48 season, and possibly longer.

Representations made by the High Commissioner's Office to the Board of Trade in London for an increased allocation of nitrogenous fertilisers were not successful, and, therefore, until such time as adequate supplies become available, the rationing of fertilisers will need to be continued if equity of distribution is to be maintained.

Soil Survey. A number of local soil surveys were carried out for immediate practical use. It was not, however, possible to commence a general soil survey of the agricultural area on account of shortage of staff and transport. It is hoped to make a serious start with the work of classifying and mapping the soils of the Colony in the coming year.

Co-operative Investigations. Very useful research and investigations were carried out in co-operation with the branches concerned in the fields of Pasture Research, Dehydration and plant Pathology.

TOBACCO INDUSTRY.

Production. The acre yield of both flue-cured and dark fire-cured Virginia tobacco was very good considering the adverse seasonal conditions under which the crops were grown, but the quality of the tobacco was not good. The season proved more favourable for the Turkish type crop and resulted in a fairly high yield of medium quality being harvested by the growers.

Only limited stocks of fertilisers were available and supplies to growers were strictly rationed. The maximum allocation to any grower remained at last year's level, namely, 300 lbs. per acre. The requirements of ex-Service men commencing tobacco growing operations on their own farms were met from a stock of fertiliser specially reserved for that purpose. In order to eke out their fertiliser supply, an increased number of tobacco growers made supplementary applications of kraal manure and compost to their tobacco lands.

Native labour remains a problem on many farms and an acute shortage of labour seriously hampered the harvesting of the crop. In some instances an appreciable acreage of tobacco remained unharvested. The greatest difficulty in obtaining native labour was experienced by new settlers, the majority of whom are ex-Service men who commenced farming operations this season.

Admission to the register of growers of Virginia and Turkish tobacco and the allocation of basic acreage quotas to tobacco in pursuance of the policy introduced during the war period was controlled in accordance with the general requirements of the industry and the available stocks of artificial fertilisers. The number of applicants for admission to the register of Virginia tobacco growers was 1,273 (including 211 ex-Service men), compared with 925 (including 32 ex-Service men) registered in the 1945-46 season and 848 growers in the 1944-45 season. The applications for admission to the register of Turkish tobacco growers number 1,405 (including 179 ex-Service men), compared with 1,026 (including 56 ex-Service men) registered in 1945-46 and 760 growers in 1944-45.

Markets. The acreage planted to flue-cured tobacco was 74,420 acres and to fire-cured 1,019 acres, and to sun- and air-cured tobacco 61 acres. Some 10,632 acres were planted to Turkish type tobacco. In comparison with last season, the acreage under flue-cured tobacco increased by 3,373 acres and dark fire-cured decreased by 43 acres, while Turkish tobacco increased by 769 acres. The combined production of all types of tobacco amounted to 47,219,399 lbs., representing a decrease of 4,794,326 lbs. below last year's returns.

Sales of Virginia type tobacco over the auction floors amounted to 41,548,836 lbs. flue-cured leaf, which realised £5,600,611, or an average of 32.35d. per lb. The weight of dark fire-cured tobacco sold was 563,275 lbs., valued at £39,811, or an average of 16.96d. per lb. Growers consigned direct to overseas markets 308,600 lbs. of flue-cured tobacco valued at approximately £38,578. There was no consignment of dark fire-cured tobacco.

Receipts for Virginia type tobacco therefore amounted to approximately £5,679,000, compared with £3,904,767 received by growers for last year's crop.

A special feature of the auctions this year was the marketing of 279,299 lbs. of N.-W. Rhodesia flue-cured Virginia type leaf, which sold for £33,760 5s. 11d., or an average price of 29.01d. per lb. It is expected that the sale of Northern Rhodesian tobacco will become a permanent feature on our local tobacco auction floors.

The weight of tobacco exported to Protected Markets was 29,965,086 lbs. flue-cured and 238,682 lbs. dark fire-cured, making a total of 30,203,768 lbs. Virginia type tobacco despatched to these markets. The exports to Foreign Markets were 10,196,567 lbs. flue-cured and 27,528 lbs. dark fire-cured tobacco. In all, 40,427,763 lbs. of Virginia type tobacco was exported from the Colony during the year. The number of export permits issued for this tobacco was 1,833, including permits for 266 samples.

The question of marketing Southern Rhodesia Turkish type tobacco by auction was finally determined by the growers in a referendum held during July. The first sale of Turkish tobacco over the auction floor was held on 9th September, 1946, and regular sales followed throughout the season, which closed on 29th November, 1946. The auctions were organised and conducted under the aegis of the newly-appointed Southern Rhodesia Turkish Tobacco Industry Board and worked smoothly from the start. The results to growers and buyers are reported to be satisfactory. The total weight sold amounted to 1,175,118 lbs., which realised £106,254 17s. 1d., or an average of 20.17d. per lb. The bulk of the crop, however, is sold under contract by the Turkish Tobacco Co-operative Co. of Rhodesia, Ltd., and consequently no official sales figures are available in regard to this portion of the crop, but it is estimated that the average price received by growers was 22d. per lb.

The quantity of tobacco marketed through the agency of the Turkish Tobacco Co-operative Co. of Rhodesia, Ltd., was 3,393,346 lbs., valued at £311,056, thus bringing the total weight sold to 4,568,464 lbs., valued at £417,311.

Parcels of Northern Rhodesia Turkish type tobacco are marketed in Southern Rhodesia each season, but the weights are not included in the figures stated for Southern Rhodesia tobacco. During 1946 the quantity of Northern Rhodesia Turkish leaf sold here was 755,360 lbs.

The quantity of Turkish type tobacco exported from Southern Rhodesia during 1946 amounted to 4,689,999 lbs., of which 770,890 lbs. was despatched to Empire countries and 3,919,109 lbs. to Foreign Markets. The total value of these exports was £469,000. Altogether 223 export permits were issued, including permits for 82 samples.

In common with tobacco producers throughout the British Commonwealth, the Southern Rhodesia tobacco industry is very perturbed over the possibility of the Imperial Preference being

withdrawn. Suitable representations have been made to the Imperial Government by our own Government stressing the vital importance of the preference to our tobacco industry and asking that it be retained if possible. The tobacco industry is of major economic importance to Southern Rhodesia, as can readily be appreciated by the fact that the total value of the 1945-46 crop amounted to £6,096,311 approximately.

New legislation introduced during the year included the Turkish Tobacco Act, 1946, which was promulgated on 1st March, 1946. This Act is for the better organising of the industry and orderly marketing of Turkish type tobacco.

Experimental Work. Principally for the benefit of ex-Service men settlers in the Karoi Land Settlement Area, the Karoi Experiment and Demonstration Farm, under the direction of the Chief Tobacco Officer, was opened on 3rd July, 1946. Work was hampered by lack of water and difficulty experienced in securing native labour, but a limited acreage was planted to Virginia flue-cured and Turkish type tobacco, cotton, ground nuts, and general farm crops before the end of December, 1946.

Following on the completion of the development work on the Turkish Tobacco Plant Breeding Station, Umgusa, Bulawayo, irrigation experiments, wilting experiments, curing experiments and a new series of rotation trials were introduced this year. The new buildings constructed include a guest hut, one wilting room, one store room and a cottage for the Technical Assistant.

A comprehensive plant for the extension of tobacco research and experimental work has been drawn up during the year. It is hoped that considerable expansion of these essential activities will be realised during 1947.

General. The Colony owes a great deal to the tobacco industry, which is now expanding about as rapidly as the supply of labour and fertilisers, the limiting factors, will allow. It will be a difficult matter for this country to assimilate this expansion without either displacing food production or raising the price of food products to artificial levels, in competition with tobacco. This problem has been referred to elsewhere in this report. There is an obvious danger in investing everything in tobacco as many newcomers to the industry are doing to-day and, in the long-term interest, tobacco farmers must diversify their efforts more and maintain some economic balance in their enterprise. Established growers are realising this and are investing more of their capital and labour in other forms of farming as opportunities permit.

DEPARTMENTAL REPORTS.

The detailed reports relating to the work performed by the Department of Irrigation, Lands, Surveyor General, Veterinary and Veterinary Research have been submitted separately to the House. Only very brief references have been made in this report on matters dealt with by these important Departments.

CONCLUSION.

I have to record the retirement of Mr. C. L. Robertson, O.B.E., Secretary, Department of Agriculture and Lands, during the year. He has left behind him a very high standard of service, and I wish to express my thanks to all members of the Division for the willing co-operation and loyal support which has made the task of taking over from him much easier than it might have been.

In addition, I must pay tribute on behalf of the Division of Agriculture and Lands to the great assistance rendered by the Rhodesia National Farmers' Union, the Rhodesia Tobacco Association and kindred associations, the Food Advisory Committee and the Natural Resources Board. The co-operation of these bodies is of decisive importance.

A. E. ROMYN,

Secretary, Department of Agriculture and Lands.

Farming Calendar.

By the Officers of the Department of Agriculture.

[Owing to numerous requests for an up-to-date bulletin on farming notes, the following notes have been compiled by the various officers of the Department of Agriculture.

The notes from September to February are given below, and it is hoped to publish the March to August notes in the next issue.

The notes will then be published in one complete bulletin, entitled "Farming Calendar," towards the end of October.—Ed.]

SEPTEMBER.

GENERAL CROPS.

Prepare your compost heaps. Utilise your labour to the fullest extent for stumping and clearing more land for mixed crops, and for general farming development. Do not be satisfied unless each year sees more profit-earning development work effected. Good organisation of the farm work will permit of much being done without great cost. Press on marking out holes for hand planting of maize, and apply manure and fertiliser. Phosphatic fertilisers, which are to be broadcast and ploughed or harrowed in, can be applied. Lands may require a second ploughing about this date, before being seeded. Danger from frost should be past now, and crops susceptible to frost, such as potatoes, may be planted where land is moist. Pumpkins and early maize may be planted in vlei lands. Edible canna may be planted dry, during the latter half of this month. Overhaul all implements and replace worn parts. Putting this off until the planting season may mean serious loss of planting opportunities. Ploughing and cross-ploughing should be hurried on; also the ploughing under of farmyard manure. Make every effort to secure as good a seed-bed as possible; good seed-beds mean early planting and good stands; and good stands are all-important in securing good yields. Do not make the seed-bed so fine that soil erosion is encouraged.

TOBACCO.

Hasten the preparation of seed-beds for flue-cured type of tobacco. The first batch of beds should be seeded about mid-September; subsequent seeding of the remaining beds should be done in batches at 10 to 14 day intervals. The last lot of beds is sown normally by the end of October. Seed-beds for dark fire-cured type of tobacco should be prepared for seeding, which commences after the first week in October.

For Turkish type tobacco the first seed-beds are sown from mid-November onwards and from two to three weeks earlier in Matabeleland.

FORESTRY.

All cuttings struck in sand in July and not yet transplanted into good soil should have this done as soon as possible. Preliminary sowings of Eucalypt seed should now be made on a small scale, so that transplants will be ready in case the first half of the rainy season should prove favourable; otherwise bulk sowings should be postponed until October-November. The fire season will now be at its height, and care should be taken to see that all plantations are protected.

CITRUS FRUITS.

The fate of the citrus fruit crop is dependent upon the treatment the trees received during this month. If the trees have been given the treatment recommended in the August Calendar, and this treatment is followed by good irrigations and cultivation, a good crop of fruit may be expected, whereas a total failure will be the result if the trees suffer for want of moisture at this season of the year.

If not already done, all top-worked trees should be headed back early in the month. This cutting back will induce the dormant buds (set in autumn) to commence growth. As the new shoots develop, the old tops may be further shortened back until the top is displaced with a new but profitable one.

The packing of late varieties must be speeded up and completed, if possible, by the end of the month, as the late-picked fruit is likely to deteriorate in quality or come into competition with Mediterranean fruits.

All adventitious shoots (water shoots on the main stem and suckers) must be cut off as they appear, and this work should be continued throughout the growing season.

DECIDUOUS FRUITS.

Newly planted trees must not be permitted to become too dry; watering by hand or gravitation must be continued until the rains commence. Ten gallons of water every fourteen days is sufficient for young trees. These applications should be followed by the loosening of the soil and mulching to prevent undue evaporation of the added moisture. Keep buck from damaging young trees.

All undesirable growths on the stem and in the centre of the trees should be suppressed as they appear; this will enable the retained shoots to develop normally.

Early fruits must be thinned out this month; only retain two or three fruits on each bearing twig or shoot. Those that are left will then develop into large and attractive fruits. Remove any apples at the tip of shoots. Lime sulphur spraying at summer strength 1 - 60 will be necessary with apple trees suffering from mildew.

VEGETABLE GARDEN.

Sow French beans, leeks, spinach, cucumber, egg plants, celery, rhubarb, melons and tomatoes. Small sowings of peas, turnips, beet, lettuce, radish, carrots, parsnips and cabbages may be made now. Give side dressings of vegetable fertiliser to plants that are making slow growth, particularly in newly broken ground.

FLOWER GARDEN.

Cultivate extensively to prevent the soil surface becoming hard and to keep weeds in check. Water plants newly set out, especially such as have their roots near the surface. Thin and regulate growing shoots on roses and various shrubs. Plant out cannas and chrysanthemums (for massing and border decorations) and other herbaceous plants. Divide violet plants and replant in fresh, well-manured positions.

INSECT PESTS.

Tobacco. If possible, use fresh seed beds. A site infested with nematode or eelworm should not be used for seed beds; the site can sometimes conveniently and profitably be planted to trees. For watering seed beds use water from a borehole, well, or mid-stream in that order of preference to avoid infestation by eelworm from the water supply.

Seed bed plants may suffer from cutworms. Clearing the whole seed bed site including a strip of about 30 yards around it is advised as a July operation with the purpose of starving out all stages of cutworms. If this was not done, do it now, and if cutworms are normally troublesome, bait the whole site by broadcasting a cutworm bait late in the afternoon, keeping it away from any growing tobacco seedlings. Various baits can be recommended and they all need to be applied moist in the evening when cutworms mostly feed. One bait is made of a moistened mixture of 1 lb. Paris green or sodium fluosilicate and 20 - 25 lbs. wheat bran. Another is finely cut up succulent such as spineless cactus, or other finely cut-up greenstuff, steeped for several hours in a solution of 6½ oz. sodium fluoride in two gallons of water.

Burn over the seed beds with brushwood before sowing commences. Keep the beds well covered with seed bed cloth in the late afternoon and night. The bricks surrounding the beds should be well joined and free from gaps.

On seed bed sites where small black or brown ants are known to carry away the germinating seedlings to a serious extent, the ravages of these insects can be avoided by spreading over the newly sown beds a one-eighth inch deep layer of cleaned river sand of medium grade.

When the seedling leaves are about the size of a sixpenny piece, begin regular weekly spraying with lead arsenate powder, 1 lb., water 30 gallons, plus a spreader. The lead arsenate should be mixed with a small quantity of water to form a smooth paste before adding to the rest of the water. It is wise to incorporate tobacco extract in the lead arsenate spray and both may be

incorporated in the Bordeaux mixture used against diseases, provided that home-infused tobacco wash is not used. Sprays containing lead arsenate and/or tobacco extract should not merely be sprayed lightly over the tops of the seedlings but should be applied in a fine, forceful spray which will penetrate the dense cover of foliage. If bucket pumps are used it is advisable to have at least three yards of rubber hose attached. Where pneumatic type pumps are used, operators should be made to keep up the right pressure. Equipment should be cleaned out with water after each day of use.

Examine all tobacco lands more than once to ensure that they carry no regrowth from the previous tobacco crop.

For cleaning of tobacco sheds, barns, and store rooms, see August notes.

The walls, rafters, equipment, etc., of tobacco rooms can, as a wise precautionary measure, be sprayed with D.D.T. The best time for this would be in the first half of September, but up to the first week of October is suitable. D.D.T. spray should not be applied at the same time as whitewash, nor for a week or two after whitewashing has been applied. A fairly concentrated wettable powder sprayed on by means of a knapsack sprayer or stirrup pump (not a household atomiser) should leave a good residual coating of D.D.T.

Cotton. By law, all cotton plants must be destroyed by 1st October each year. Cotton standing after September harbours red bollworms, stainers, and jassids, and encourages them to multiply. Hibiscus weeds and wild hosts of the stainers should be sought out and destroyed.

Potato. Early crops are liable to suffer from leaf-eating caterpillars and beetles and may be sprayed with lead arsenate, 1 lb. in 25 gallons of water, plus spreader, or with other more or less insoluble arsenical dusts or sprays, or with certain fluorine dusts, or with modern synthetic organic insecticides as may be advised by the manufacturers.

Tubers infested with eelworm should not be planted, nor should eelworm infested land be used for the summer potato crop.

Legumes. Beans planted under irrigation during September usually escape serious infestation by stem maggot.

Orchard. Black citrus aphis may be present on new growth and if troublesome it may be controlled easily by commercial or home made tobacco sprays.

Thrips may be present on the very young citrus fruits. To combat them, spray with a bait of 2 lbs. tartar emetic, 2 lbs. white sugar, and 100 gallons of water. Somewhat stronger concentrations have also been advised. Several applications at about ten-day intervals may be required. D.D.T. sprays have also been found effective.

The early, regular, frequent, and effective disposal of fallen and stung fruit of any kind infested by False Codling Moth is important in the control of that insect.

Garden. Green-fly or aphis on cabbage may sometimes be kept under control by repeatedly dislodging them by means of a powerful spray of water aimed at the under sides of the leaves and in the crown of young plants. Good garden-hose pressure is sufficient. A surer method is the use of tobacco extract sprays as recommended by the manufacturers. Do not "put in a little extra" when the pest is severe on well-grown plants, because in these circumstances certain parasites are present in large numbers and may be killed by too concentrated a spray, although not affected by normal sprays. Spraying should nevertheless be thorough.

Webworms and other caterpillars attacking young cabbage and similar plants may be controlled by dusting with a mixture of 1 lb. Paris green and 20 lbs. finely sifted hydrated lime or flour, or 1 lb. lead arsenate powder to 4 parts of fine lime, or with D.D.T. powder. The dust should be applied by means of dusting-bellows or a dust gun, or, under larger scale conditions, by appropriate dusting equipment. Spraying with 1 lb. lead arsenate in 30 gallons water plus spreader can be substituted for dusting, but it is often difficult to obtain an even deposit on cabbage leaves. Flea beetles which appear later on turnips may be controlled in the same way. Do not use poisonous insecticides on leaves which are to be eaten, therefore stop spraying with these a few weeks before plants such as cabbage are to be ready. Derris and similar insecticides can be substituted during this period.

Young marrows, cucumbers, melons, etc., may be badly damaged by beetles. They can be protected by gauze covers. When larger, they withstand attack. Unthrifty plants may be found to be infested by aphids on the under sides of the leaves. If so, spray with tobacco extract and soap.

In most agricultural pursuits, remember:—

"*Cleanliness Aids Insect Control.*"

PLANT PATHOLOGY.

Overhaul pumps and fit new washers where necessary. Examine hoses and nozzles; replace worn parts. Order spray material for wet season; do not forget a spreader. Purchase seed disinfectants and treat seed of maize, monkeynuts, peas, cabbages, cauliflowers, turnips, cucumber and other vegetables.

Prepare tobacco seed-beds ready for burning. Burn veld round seed-bed site to inhibit aphis and avoid rosette. Make sure seed is cleaned and treated.

Remove and destroy all old Turkish tobacco stalks by September 1st; bury all remaining refuse in compost heap or pit. Make arrangements for spraying the new crop.

Spray irrigated potatoes with copper fungicide.

Apply lime sulphur sprays to deciduous fruit trees according to stage of bud development. Dust vines with sulphur. Spray peas with lime sulphur (1 - 60) when weather is hot to eradicate mildew. Keep tomato beds well mulched to prevent blossom-end

rot. Do same with lettuce to prevent head rot. Spray strawberries with lime-sulphur (1 - 100), and colloidal sulphur (1½lb. - 100 gallons spray), plus 40% nicotine extract (1 - 800) or dust with sulphur and nicotine to control mildew and virus diseases.

BOTANY.

These are the months when the "Tulps" (*Moraea* spp.) and "Slangkops" (*Urginea* spp.) appear and during this period are likely to be the cause of veld poisoning in cattle. They will be coming into flower at this time of year and if suspected of causing veld poisoning, whole plants, tightly wrapped in newspaper, should be sent in to the Branch of Botany and Plant Pathology for identification. September is also the month when N'Kausaan (*Dichapetalum cymosum* L.) will be flowering. It occurs only on the Kalahari sands of the Bulawayo area but at this stage it is likely to cause cattle deaths and cattle should not be allowed to graze freely on it during this period. It need cause no worry at other times of the year as it is only at flowering time that it is poisonous.

PASTURES.

This is a good month to cut out scrub and bush growth if labour is available. The ideal to aim at in Rhodesia is parkland which can be mown, as the use of the mower is normally the cheapest means of controlling weed and scrub encroachment. Mowing is also the best means of avoiding the necessity for burning and improving the quality and carrying capacity of veld grazing, so carry on with this operation as far as possible. The mown grass will make useful compost.

Vlei land burnt in August should be greening over. Care should be taken not to commence grazing too soon, as too early use reduces growth, and once on green pasture, stock lose their taste for dry grazing. It is best to put the animals on the vlei for a few hours a day only at first. Burn off the remaining vlei land to be burnt that season.

Planted vlei land pastures should be producing useful feed this month. Graze rotationally if sufficient paddocks are available and avoid over-grazing.

CONSERVATION.

The following is a short summary of Conservation work tabulated for carrying out on a month by month basis:—

1. Construct new contour ridges.
2. Rebuild old contour ridges.
3. Road repair work, paying special attention to disposal of water from road drains.
4. Maintenance work on storm drains.
5. Primary gully control work. This should include fencing of gullies and badly eroded areas.
6. Construct pasture furrows and vlei contours.
7. Carry out veld fire protection measures, with particular regard to gullies.
8. Prepare holes for planting kudzu.

LIVESTOCK.

Beef Cattle. Ranching cattle go through a very critical time from now on, and cows with calves at foot will be getting very thin. Go through them carefully, sort out the thin cows and wean their calves. Put the cows on better grazing and do everything possible to keep the weaners going. If ample roughage is available, pen them. If not, put them on good grazing and if necessary feed a pound of cubes or 1 to 2 lbs. of cotton seed each, daily. Keep a close watch on cows showing signs of early calving and give any in need of it assistance in the form of silage, legume hay, cubes or some other suitable supplement. In the drier parts of the Colony calving should, of course, not commence before green grazing is assured.

Apart from thin cows, go through the herd and sort out and assist any animals which may need it. One always gets some thin cattle at this time of the year and assistance is more economical than selling their hides. Do not let cattle go back so much that they cannot be pulled through.

Don't forget to give the bulls extra attention and feed so that they will not get too thin.

Where steers are being fattened in pens they should be fed according to their condition. Towards the end of the fattening period 10-14 lbs. of concentrates each per day will be necessary.

Dairy Cattle. In the better rainfall areas early green grazing will be available in vleis. Depending on the amount and quality of it, continue or discontinue with the feeding of succulence and hay. Concentrate feeding should be sufficiently liberal to maintain production on a high level. In the dry parts of the Colony dairy herds should be kept in the pens and fed all the good quality veld hay and/or maize stover they will consume. Legume hay and silage should, of course, be continued with, as well as adequate concentrates.

In-calf cows or heifers which are uddering up should be fed to calve in good condition, and young heifers should be fed sufficient good roughage to maintain them in good thrifty condition. Veld hay ad lib, plus 5-6 lbs. legume hay and 20 lbs. silage, is the most practical ration for this purpose.

Sheep. March lambs, if well grown, should be weaned and either put on to good grazing or allowed ample bean hay and a little maize. Do not let them get a setback, but keep them going so that they will be in good condition and make profitable weights by Christmas. Before weaning, mark the mothers of any weedy lambs and fatten them for sale, too. They are useless for breeding purposes.

Continue dosing at 3- to 4-weekly intervals as per veterinary instructions.

As next month is the best time to put the rams to the ewes, give the latter some feed, such as a little bean hay and silage if they are not on green grass. This will ensure that they are in an improving condition when bred and larger lamb crops will be obtained.

Make sure that the rams are also in good condition and ready for work.

Pigs. At this time of the year pigs getting no good quality legume hay or green feed often suffer from vitamin deficiency. It is very important, therefore, that they should get a handful of green feed daily. On most farms very little separated milk will be available. Where this is the case, be sure to include sufficient (10%) carcase meal in the concentrates.

DAIRYING.

Now that the hot weather is approaching, it becomes necessary to concentrate in detail on methods of production.

Undesirable fermentations, gassiness and over-ripe returns are more prevalent during the warm and hot weather.

Milking operations should be carried out with the utmost care. Udders should be washed immediately before the milking operation, preferably with a weak disinfectant solution such as permanganate of potash.

The use of reims should be discouraged and cow hobbles used for securing the legs of cows during the milking operation.

A supply of fresh clean water should be available and cows should not be permitted to water at dams or stagnant pools.

Dairy utensils should receive special attention during the hot weather and added precautions taken to ensure that buckets, cans, etc., are cleaned immediately after use first in cold water, then in hot water to which soda or some other washing compound has been added and finally in clean water to remove all traces of the washing compound.

Sterilization of all dairy utensils after each washing is of the utmost importance.

VETERINARY.

During these months veld poison will probably appear due to the cattle eating poisonous plants which appear in burnt veld and in the vleis before the early grass. Deaths from tick-borne diseases should be very little in evidence.

POULTRY.

Poultry of all ages—fowls, turkeys, ducks and geese—suffer from exposure to the sun's rays if not provided with shade. Like humans, they must be able to move from sunshine to shade sometimes as required. As the summer weather sets in, a free circulation of air in the runs and shade during the day are essential for their well-being. The sleeping quarters should be well ventilated at night. One often finds the growing stock overcrowded at night with the minimum ventilation and the runs enclosed with grass screens long after the hot weather has set in. This must be avoided. Whilst grass screens are useful protection against wintry winds, they must be removed as the hot weather approaches. Provide ample overhead shade, preferably the natural shade of trees.

Above all, avoid overcrowding the hoppers and sleeping accommodation. This saps the vitality and may lead to cannibalism and mortality.

The importance of ample succulent green food to poultry of all ages during the forthcoming hot months cannot be over-emphasised. It should be supplied in hoppers or wire baskets twice daily, as much as the birds can consume, at 7.30 a.m. and again at 5 p.m. A lack of green food impairs the health of poultry of all ages. In the case of a laying flock, fewer eggs are produced, often with watery white and pale-coloured yolks. The growing stock is more susceptible from a health point of view, resulting in stunting and a dietetic condition known as nutritional roup, followed by mortality. A liberal supply of green food, either succulent or leaf meal, must be included in the daily bill of fare. The feeding of yellow maize when available also has beneficial results in that respect. The symptoms of the condition referred to are similar to those found in the infectious form of roup, but without the characteristic odour associated with roupy disease. There is no doubt that many young growing stock are adversely affected each year by a lack of green food. During the dry season the available supply of green food is usually much reduced, when it will be a good opportunity to make full use of leaf meal in the mash, and if necessary, sprouted cereals could also be used to advantage. Leaf meal, either dry sunflower leaves or lucerne at the rate of 10 per cent. should be incorporated in the mash.

Continue to cull out unprofitable birds from the laying flock; those in trap-nested flocks are easily detected. By this time there should be many surplus cockerels fit for disposal at twelve weeks of age; their accommodation would be put to better use for occupation by the growing pullets. Keep the best of the stud cockerels, get rid of the remainder during the next few months. Caponising is done at eight weeks old in the case of the light breeds and ten to twelve weeks when applied to the general purpose breeds. Full details of this operation and rearing and fattening of table poultry are given in Departmental Bulletin No. 1312. Cull out the unprofitable birds in the laying flock, and the growing stock which are not making satisfactory progress, and all surplus cockerels.

Egg prices during the last half of the year are lower than those during the first half. Egg prices in relation to production move the opposite way. When production is at its peak, prices are lowest; when production is lowest, prices are highest. This is the answer to the question as to why the price of eggs, in contrast to the price of other human foodstuffs, is subject to fluctuations which reflect in the cost of living statistics.

Poultry foods are accountable for 50 per cent. of the cost of egg production and table poultry. The relationship between the price of eggs and the price of poultry food is most important at this period of the year. When egg prices are high in relation to the price of food, conditions are favourable for egg production. When the price of eggs is low in relation to the price of feed, conditions are unfavourable. The factors that cause egg prices to be high or low in relation to feed costs are largely beyond the control of individual poultry producers. Feed costs are generally

static with a tendency to increase irrespective of the general price for eggs. It is obvious, therefore, that rigorous culling of all surplus and unproductive stock is an important economic feature at this season of the year, and so to maintain to some extent the monetary returns from the poultry flock.

Eggs. Marketable eggs deteriorate rapidly when exposed to high temperatures. They should be collected at least twice daily during the hot months of the year and placed in a cool situation not exceeding a temperature of 70 degrees F. if possible. They should be marketed at regular and frequent intervals, preferably within three days after production. Waterglass is a satisfactory preservative for the home preservation of eggs. The production of infertile eggs is recommended for commercial purposes, either storage or for market.

Ducks. Ducklings which are being reared for table should not have access to swimming water. They are required to make the maximum gains in weight in the shortest possible time and swimming exercise should be reduced to a minimum. In the case of ducklings selected for future breeders or the laying flock, these should be allowed swimming water when well grown, from about twelve weeks of age.

OCTOBER.

GENERAL CROPS.

Prepare your compost heaps for rains. If not already attended to, overhaul all farm implements and replace worn parts to ensure efficiency. Shell ground nuts required for the season's planting. Ploughing of old lands should at latest be finished this month. If seed potatoes will not keep in good condition until next month they may be planted now, but they must be planted deep. Edible canna may be planted this month before rain falls; also velvet and dolichos beans towards the end of the month for green manuring. Harvest winter cereals, and plough under the stubble as soon as possible after harvesting. When rains have fallen, make every effort to improve the tilth of those lands which will be planted first. On cloddy lands already ploughed, seize the opportunity to break down the clods by drag and disc harrow, as showers of rain fall. A spiked roller is very useful for this work. A good tilth means good planting, and a good stand of maize. When necessary, keep the harrows going to check early weed growth. Clean lands at this time of year are an insurance against cut worm and other pests. If weather conditions permit, plant a trap crop of maize to attract stalk borer, and to feed to pigs and other stock. New land to be ploughed, and intended for planting this season, should be cleared of heavy grass or weeds, by burning or cutting for compost, to ensure good work being done by the ploughs. Such land is best planted to legumes or potatoes. Seasonal showers of rain are liable to spoil unburnt bricks unless protected. Clean out guttering and down spouts of house and farm buildings. Press on with development work so as to complete it before rains break, and with holing lands for hand-planting maize.

TOBACCO.

Continue to sow seed-beds. Where grass has been put on the seed-beds to assist germination, a daily inspection should be made, and as soon as the first few plants make their appearance, the grass should be raised up a little from the bed to prevent the plants growing spindley. All possible preparation for the coming planting season should be made.

FORESTRY.

The main sowings of Eucalypt (Gum) seed should be made either in trays or in well prepared seed-beds. A well broken soil forming a fine tilth in the seed-bed ensures more successful germination and better plants.

If transplants are being used, any seedlings which are ready should be pricked out.

Seedlings in open beds may have their tap roots cut, so as to develop fibrous lateral roots and thus produce good type stocky plants. Remember the plant feeds through its roots, hence the better the root system the healthier the plant and the greater its chances of successful establishment. If conditions are favourable, cross-plough and harrow, or pit land for planting broken up in early autumn. Continue to guard against fires.

CITRUS FRUITS.

Citrus trees should not be permitted to suffer for want of water if a good setting of fruit is desired. Continue irrigation at fairly frequent intervals, especially if it is windy. Cultivation must follow each irrigation when soil is fit to work, otherwise a large amount of moisture will be lost by evaporation. The packing of late fruit for export should be completed early in the month or before the rains commence. Suppress all stem growths or water shoots as they appear. Young trees planted last season may with advantage have the stems whitewashed or washed with Bordeaux mixture paste; this will prevent undue sun-scalding of the unprotected stems. Plant cover crops with the first good rains.

DECIDUOUS FRUITS.

Keep all trees well watered until the rains commence; cultivate after each watering to prevent evaporation of added moisture. Rub off all undesirable shoots, such as those arising on the main stem near the ground; also those shoots having a tendency to crowd each other. Two or more shoots should not be allowed to develop from the same spot on any part of the tree. Rub off the weaker ones after they appear. The fruit of early peach trees should be thinned out if a heavy crop has set; this thinning will result in a crop of large-sized fruit. All fruit should be thinned out if necessary.

VEGETABLE GARDEN.

As in September, nearly all vegetable seeds may be sown. Early potatoes should be earthed up when reaching the height of about eight inches. In planting a small amount of marrow, melon,

cucumber and pumpkin, the writer has found it economical to sow the seed one in a tin and transplant when about four inches high in hills. A few cucumbers planted in this manner yielded nearly 400 a week for about two months. Sweet corn and maize may also be sown this month.

FLOWER GARDEN.

All flower seeds, annual and perennial, may be sown as in September. A word or two on open seed-beds may not be out of place here. These beds should be prepared in a sheltered position, and the soil should be well and deeply dug. This is most essential, as in this state the soil, when once watered, is more easily kept moist, and is not so liable to cake. The top dressing should be free from all undecayed vegetable matter, and when sown the seeds should be covered with a thin dressing of fine, light soil, over which a thin covering of grass may be placed to check evaporation. Transplanting from boxes or beds should be done on a dull day or towards evening; the plants should be well watered before being removed, and the roots disturbed as little as possible, care being taken that the latter have their full depth and spread when planting. Rose budding of briars may now begin. Give the soil a good watering two days earlier to make the bark lift easily.

INSECT PESTS.

Maize. Early maize planted late in October is liable to suffer from stalk borer in December, but where maize sown early in October can get away it will often be too large to be attractive when stalk borer moths are about. In general, December plantings should be the rule. The black maize beetle, sometimes very numerous in vlei lands, is now in the pupal stage. Thorough working and breaking up of the soil will destroy large numbers.

For details of a tar emulsion dressing to ward off attack on maize seed by false wireworms and other soil inhabiting pests, write to the Chief Entomologist.

Tobacco. Continue the use of seed bed cloth, the weekly applications of spray, and, if necessary, the sanding of seed beds. See September notes for these and other seed bed precautions.

Examine the lands again for regrowth and make a point of destroying any that may be found. At the same time, the hills made by large sand crickets can be marked down. The crickets may then be poisoned by placing about a teaspoonful of a moistened mixture of 1 part by weight of Paris green or barium fluosilicate powder with as much as 50 - 60 parts of maize bran or meal in its main burrow which is usually readily found under the heap of soil which it has excavated. Twice the amount of poison is often advised. The holes should be re-covered lightly with soil.

All tobacco store rooms, sheds or barns should have been very thoroughly cleaned and lime-washed by now (see August). Applications of D.D.T. to the walls, etc., may be made early in the month, although September applications (q.v.) would give more complete protection from pests of stored tobacco.

Potato. See September notes regarding leaf-eating caterpillars and eelworm.

Orchard. Scale insects on citrus trees may be controlled by several applications of resin wash or oil sprays, at fortnightly intervals. Black citrus aphis may be present on new growth, but if troublesome it may be controlled easily by commercial or home-made tobacco sprays. In the control of thrips, spraying with a bait of 2 lbs. tartar emetic, 2 lbs. white sugar, and 100 gallons of water has been found successful, though stronger concentrations have been advised. Several applications at about ten-day intervals may be required. D.D.T. sprays have also been found effective.

Fruit flies attacking peaches and other deciduous fruits, and giving rise to maggoty fruit, can be poisoned by using a bait made by mixing 1½ ozs. of arsenate of lead powder to a smooth paste with a little water and mixing this paste into a solution made by dissolving 2½ lbs. white sugar in 4 gallons water. Alternatively, the bait described below for citrus trees can be used on deciduous trees. The bait should be sprayed, preferably through a rose-type of nozzle or sprinkler, lightly over the trees, so that drops of it will fall on the leaves, where they can be readily found and fed upon by the adult flies. A garden syringe is a useful appliance, one or two syringefuls being used per average tree. The bait should be kept well agitated during operations. Freshly made bait should be applied once or twice weekly, and also when the foliage has dried after a washing rain. Stung fruit should be picked from the trees and fallen fruit collected, and all should be taken care of at once by being deposited in boiling water, or for several days in water in which a film of paraffin oil is floating, or by burying under at least two feet of well packed soil, or by being fed at once to stock. The boiling water method is probably the quickest and most complete and economical if the fruit can be utilised subsequently for feed, composting, or other purposes. Treatment must be thorough, frequent, and immediate. Choice varieties of peaches can be netted against these pests and against fruit-piercing moths.

In commercial citrus orchards out-of-season fruit should be picked. Infested fruit should be destroyed as described for deciduous fruit. When it is desirable to bait for fruit flies on citrus trees, the lead arsenate bait described above should NOT be used. Instead, use in the same way a bait made by dissolving 1 to 1¼ oz. of sodium fluosilicate, and then 2 lbs. white sugar, in 4 gallons water.

Figs infested with grubs of the fig weevil should be collected and destroyed.

Chafer beetles attacking the leaves of deciduous fruit trees and grape vines can be killed by arsenical foliage sprays which should, however, be prepared somewhat stronger than usual, e.g., 1 lb. to 20 gallons water, plus spreader. Many can be caught and killed by suspending a lighted lantern over a half-drum of water on which a thin film of paraffin oil is floating.

Garden. Gardening notes for October do not differ from those of September, q.v.

In most agricultural pursuits, remember:—
"*Cleanliness Aids Insect Control.*"

PLANT PATHOLOGY.

Spray tobacco beds every five days from time when leaves are the size of a shilling. Prevent the use of snuff or smoking tobacco by boys and wash hands frequently.

Spray deciduous fruit with lime sulphur (1 - 100) to control mildew.

Spray plants of cabbage family weekly with nicotine to control aphis, which carry virus diseases. Spraying must commence as soon as the plants emerge.

Dust soil of seed-tins and beds with Bordeaux powder to prevent damping off.

BOTANY.

These are the months when the "Tulps" (*Moraea* spp.) and "Slangkops" (*Urginea* spp.) appear and during this period are likely to be the cause of veld poisoning in cattle. They will be coming into flower at this time of year and if suspected of causing veld poisoning, whole plants, tightly wrapped in newspaper, should be sent in to the Branch of Botany and Plant Pathology for identification. September is also the month when N'Kausaan (*Dichapetalum cymosum* L.) will be flowering. It occurs only on the Kalahari sands of the Bulawayo area but at this stage it is likely to cause cattle deaths and cattle should not be allowed to graze freely on it during this period. It need cause no worry at other times of the year as it is only at flowering time that it is poisonous.

PASTURES.

Vlei grazing, if available, is particularly valuable in October, and full use should be made of these pastures at this time of the year. In Msasa and Mfuti areas, these trees will afford a certain amount of useful browse, which can often be increased by lopping the branches out of reach of stock.

Labour can be usefully used to continue bush clearing operations, repairs to fencing and an overhaul of mowing implements.

Burning of dry land pastures which are excessively rank can be commenced towards the end of the month. Care should be taken to keep fires under control, and due warning given to neighbouring farmers. Do not burn pastures which have been mown that year, burnt the previous year, or well or evenly grazed down. Aim to burn the minimum necessary to get rid of rank growth and to assist in controlling scrub encroachment where this is a problem.

CONSERVATION.

1. (a) Inspect newly constructed contours and storm drains immediately after first rains to catch them *before* they break.

(b) Strengthen weak spots in banks which may have been caused through settling of ground after rain.

(c) Remove high spots in water channels while "water mark" can still be seen and while ground is still soft.

(d) Look out for weakness caused by ant holes or holes made by vermin.

2. Some grass planting in gullies and badly eroded areas may be done in December if crop planting is well in hand and suitable rains have fallen.

3. Plant out poplar tree roots or cuttings in gullies and wet land, also kudzu in holes prepared earlier.

4. Inspect grass strips and water-ways after first rains for any damage, and repair by building earth or sod diversion banks, designed to keep the water spread.

LIVESTOCK.

Beef Cattle. In the low rainfall areas this is a very critical and difficult month for the rancher, and he can do no better than spend most of his time among the cattle. Careful watching and judicious management will return handsome dividends. As in September, pay particular attention to cows with calves, wean when necessary and see that thin animals get the necessary feed and attention as was recommended for September. In the high rainfall areas the cattle will in most cases be improving on early vleis. If not, assistance will be necessary. In these parts cows will be calving heavily, and the running of a "maternity herd" is strongly recommended. With this system cows due to calve during the following fortnight are sorted out regularly and run together. This enables the rancher to give them all the necessary additional attention such animals require just before, at and after calving. The "maternity herd" should be seen daily and given the very best supervision. It is just stupidness and nothing else to run a cow for 1 to 2 years and then lose her calf at or after calving. In parts where vermin are present, it also enables the farmer to take the necessary precautions which is not always possible with the entire herd. Dehorn and castrate all calves between 2 and 3 weeks of age.

If necessary, give the bulls assistance to maintain their condition.

In parts where open water supplies are available, these should be carefully watched.

Pen-fed bullocks should be finished or nearly so. October and November prices are specially high so as to make feeding at this time of the year profitable. Before sending them in, make sure that they are sufficiently finished to make the grade.

Dairy Cattle. Where good and sufficient vlei and other grazing is available, it will no longer be necessary to keep the cows in pens. Care should, however, be taken to ensure that they do get additional succulence and other roughage if necessary. Concentrate feeding should, of course, be maintained at a sufficiently high level to maintain production.

In the drier parts, October is a very difficult month, and there is no doubt that the cows should remain in the pens and receive ample legume hay, veld hay and silage or other succulence. Also see that they have sufficient shade and water.

Dry in-calf cows and heifers due to calve shortly should be kept in good trim so that they calve down in good condition. This is always money well spent. Young heifers should also be kept in a thrifty condition on the ration suggested for September. Remember a stunted dairy heifer never develops into a good dairy cow.

Sheep. Cull out all old or poor type ewes and put the rams with the rest for March and April lambs. Try and keep the ewes in an improving condition on green grazing or some legume hay supplement. Grazing them round a bean hay stack for a few hours per day will be excellent. Also see that the rams get sufficient grain daily to keep them active and in good condition.

In the moist areas keep the sheep away from vleis and dose as regularly as clock-work according to veterinary instructions.

Pigs. Very much the same as in September. Be sure that all pigs get some green every day. If not available at all, add 5 per cent. to 10 per cent. of ground-up good quality legume hay. Where sufficient separated milk is not available, add 10 per cent. of carcase meal to the ration. Remember that sows with litters and young pigs should not be allowed out of the pens in paddocks or wallows. Also keep an eye on sows due to farrow so that there are not unnecessary losses of little pigs.

DAIRYING.

Now that the hot weather is approaching, it becomes necessary to concentrate in detail on methods of production.

Undesirable fermentations, gassiness and over-ripe returns are more prevalent during the warm and hot weather.

Milking operations should be carried out with the utmost care. Udders should be washed immediately before the milking operation, preferably with a weak disinfectant solution such as permanganate of potash.

The use of reims should be discouraged and cow hobbles used for securing the legs of cows during the milking operation.

A supply of fresh clean water should be available and cows should not be permitted to water at dams or stagnant pools.

Dairy utensils should receive special attention during the hot weather and added precautions taken to ensure that buckets, cans, etc., are cleaned immediately after use first in cold water, then in hot water to which soda or some other washing compound has been added and finally in clean water to remove all traces of the washing compound.

Sterilization of all dairy utensils after each washing is of the utmost importance.

VETERINARY.

During these months veld poison will probably appear due to the cattle eating poisonous plants which appear in burnt veld and in the vleis before the early grass. Deaths from tick-borne diseases should be very little in evidence.

POULTRY.

October is usually the hottest month of the year, and poultry raisers should see that their birds have access to shade, preferably the natural shade of trees, during the day. At the same time a free circulation of air is essential during the hot weather.

Examine all houses and, where necessary, repair them in preparation for the rainy season. Poultry must have dry quarters.

The successful management of the young stock on range depends upon proper nourishment—a suitable balanced ration, with the mash supplied ad lib. and liberal grain without waste, supplemented by green food daily; keep them constantly supplied with drinking water, and avoid exceeding the number of birds for which the accommodation was intended.

During the hot weather there are frequent complaints to the effect that the young stock have stopped growing. They have ceased to make that visible progress day by day, and seem to be listless and wanting in vigour. A temporary cessation of growth may be expected for a short period with half-grown stock about three months old that are completing the growth of their plumage. This is transitory and soon passes, but chickens may flag or become droopy with ruffled plumage before and after this stage from quite different causes. Overcrowding the sleeping quarters and hoppers, or external or internal parasites may be the cause, also monotony brought by too close confinement in the same run or on stale ground will check growth, and may induce cannibalism, the remedies for which are obvious. If flagging is due to no apparent reason, a change of diet such as a moist mash once a day often has beneficial results, or give them free range on fresh ground. The provision for shade, ample green food, and clean drinking water with a free circulation of air will go a long way to minimise the effects of the hot weather.

Any yellow-shanked adult birds of the yellow-shanked varieties should be culled. The usual culling in commercial flocks will average about 25 per cent. during the summer months, and the mortality about 15 per cent. for the year. These averages will, of course, vary with the quality and management of the individual flocks.

The quantity of succulent green food would be about 6 lbs. per day per 100 birds. The greatest need for vitamin supplements occurs during the dry season when fresh green foods are limited or not available. Cod liver oil or vitaminised oil are high in two of these, and the third is found in sour milk or lucerne leaf meal.

Ducks. Waterfowl are likely to find the hot weather even more depressing than other classes of poultry; being more susceptible to heat prostration, they cannot stand the direct rays of the sun or

a sultry environment. They must have access to shade when needed and they require even more ventilation and drinking water than do fowls. There is no doubt that under suitable conditions ducks and geese will be found to thrive satisfactorily in hot weather. It will be realised this month that convenient watering facilities are essential when large numbers of ducks are reared.

The sleeping quarters for ducks must be dry; they are otherwise susceptible to rheumatism. The grass litter on the floors should be removed and exposed to the sun to dry daily, and renewed as often as may be necessary. The floor of duck houses should be raised a few inches above the surrounding ground outside to avoid flooding in the wet weather.

September and October are important months for the incubation of ducklings to meet the Christmas demand for table purposes. The aim should be to raise well-grown ducklings in plump condition to meet the best demand.

Turkeys. The flock should be herded on free range; turkeys will find a great deal of food during spring and summer on the average farm, in the way of insect life, green vegetation and grain picked up in the lands or threshing floors. Every advantage should be taken of this natural food in preparing them for the Christmas market, in addition to the food supplied to them on their return in the evening. Those selected for breeding should be herded further afield. From this month special attention must be given to maintaining and improving the condition of the birds for sale at Christmas.

Poults should be allowed free range when they have "shot-the-red," at about fourteen weeks old. Although at this age they may be treated as adult stock, they should be herded on their own on fresh range if possible.

NOVEMBER.

GENERAL CROPS.

Have you a reserve of seed maize for replanting, and have you treated your seed to protect it from Diplodia? When the first rains fall take note of leaks, if any, in the farm buildings and carry out necessary repairs. Early in the month see that the planters, cultivators, and all implements are in perfect order, and that the planters drop the different seeds evenly and at the right distances. Try them out on the farm road. Hasten the work of getting the lands for early sown crops into as good a condition for seeding as possible, so that the first and most favourable opportunity for seeding may be seized. Young plants make more rapid growth in a good seed-bed. Utilise exceptionally early rains for weeding rather than for planting. The holes for check-row planting of maize can continue to be prepared, until sufficient rain has fallen to permit of planting. The holes should be at least 4 inches deep to allow for silting. Late-maturing velvet beans and dolichos

beans for seed or hay, may be planted dry, if the land is in good order and the seed is planted deep. On sticky soils, plant dry before the seasonal rains commence. With favourable weather planting of maize, dolichos, and late-maturing velvet beans will commence about the middle of the month, and continue as the condition of the land and the rainfall permit. Main crop potatoes should be planted from now on to January. Dhal may be planted for seed or green manuring—if for seed, a frost-free situation is necessary. Kaffir corn for seed may be planted this month. Green manure crops requiring a long growing season should be planted. Destroy, by burning or feeding, early planted trap crop maize or volunteer plants infested with stalk borer. Plant the first of two traps for witchweed before the rains. It can be sown on a disced maize stubble and covered by disc harrow. If weeds are beginning to show, keep the harrows going in front of the planters. If weeds are too advanced to be killed by drag harrow, and too numerous to be dealt with by hand, use the disc harrow or one-way disc, or lightly re-plough the land. If the tilth is good and free from trash, do not be afraid to harrow the young maize. This will save much labour later on by destroying the young weeds while they are small. The land must be free from trash, and a light spike harrow or Hallick weeder employed. Check-row your maize to reduce hand labour on witchweed control, or plant at 6 ft. x 18 ins. and use a spring tooth cultivator section, 4 ft. 6 ins. wide.

TOBACCO.

Continue sowing of seed-beds. When early beds become overgrown and hard, pull out, dig up and re-sow. Begin transplanting with the first good rains, and continue as fast as the rains and boys will allow, until the full acreage is set out. Be careful to fill in the blanks from previous transplanting before starting on new fields; use the stoutest and best plants for filling in, and try to get the tobacco in the field to grow and come to maturity as nearly at the same time as possible. Discontinue filling in when the field has been planted for several weeks and has made a good start to grow, as the later filled in plants will be choked out by the earlier ones and will be undersized. Cultivate fields as soon as plants are established to keep down the weeds.

FORESTRY.

Sowings of Eucalypt (Gum) seed should be made for late planting. If fresh seed of *Cedrela toona* is available, sowings should be made. Keep the seed-beds moist and free from weeds. The tap roots of early seedlings may be cut back in order to form hardy, stocky plants most suited for planting. Continue with pricking out if transplants are to be used. Prepare all land to be planted by cross-ploughing and harrowing along the contour, or pitting. A well prepared soil is a good fertiliser; it assists establishment and reduces failures.

CITRUS FRUITS.

If no appreciable rain has fallen, irrigation must be resorted to in order to keep the trees in good growth and to prevent any check to fruit development. This is a good month to plant green

crops. Sunn hemp is possibly the best crop to smother weed growth and supply humus-forming material after it is ploughed in. If not already done, storm drains should be made on the sloping ground to prevent erosion of the surface soil during heavy storms. Where new plantings are contemplated, the holes should be dug and everything got in readiness for planting if the trees are ready for lifting in the nurseries. All unthrifty trees could with advantage have an additional amount of fertiliser and manure applied during the month. Keep down all water shoots.

DECIDUOUS FRUITS.

Continue thinning out fruit on the trees if a very heavy setting has occurred. A small amount of large-sized fruit is preferable to a large crop of small fruit. Thin down the inner growth of new shoots if they have a tendency to crowd each other, and stop all suckers and main stem growths as they appear.

VEGETABLE GARDEN.

All vegetable seeds may be sown during this month. Tomatoes and early peas and beans should be staked. The soil should be kept loose and free from seeds, which now get troublesome. Sow pumpkins, mealies, peas and potatoes.

FLOWER GARDEN.

All seeds may now be planted. Annuals for January flowering should be sown, amongst which the following will be found to be excellent in this Colony: Balsam, calliopsis, centurias, chrysanthemum, dianthus, eschscholtzia, marigold, mignonette, gallardia, phlox, poppy, nasturtium, nigella, verbena and zinnia. These are all hardy, and may be sown in the open either in beds or in the position desired for flowering. Advantage should be taken of each shower of rain during this month to keep the soil well worked and loose. Keep the dahlias well staked and tied. Give a feed of garden fertiliser every three weeks.

INSECT PESTS.

Maize. Lands should be kept free from weeds to avoid the presence of cutworm and other insects during the planting time. Volunteer plants should be examined for early stalk borers on the leaves and in the cups, and infested plants should be removed and used for compost or fed to stock. Scattered rows of maize may be planted dry early in the month to grow ahead of the crop, these plants being employed as a trap crop for stalk borers or indicator for snout beetles. In Salisbury, at least, the safest time to plant the main crop is in December, as November plantings are liable to suffer severe damage by stalk borers.

If snout beetles or surface beetles are present in large numbers, an occurrence more common on red soils, they may be poisoned by broadcasting a bait thinly over the land or in infested patches, but not until the late afternoon so that the bait may retain its moisture. A further application may be necessary if further large numbers of beetles emerge in the lands late in the month. One such bait is prepared by dissolving 1 lb. arsenite of

soda (locust poison powder) in 10 gallons of water and using this solution to steep chopped-up succulent green-stuff such as Napier fodder, maize, or other available plants, which should be drained before being scattered. Where conditions permit, the dissolved poison may be sprayed on to volunteer plants. Early rains favour the November appearance of these beetles.

Tobacco. Continue spraying seed-beds with lead arsenate and tobacco extract (see September). If necessary, hand collect cutworms which have escaped poisoning. Keep seed-bed cloth in repair and in use.

Tobacco lands, whether planted or not, should be kept free from weeds. Look out for surface beetles; if they appear they can be controlled by broadcasting the bait mentioned above for maize pests or placing in sheltered places in the late afternoon balls made of a moistened mixture of sodium fluosilicate 1 lb. and bran 20 lbs. The beetles tend to congregate in sheltered places, e.g., under clods, shrubs, etc. If tobacco is already planted out and beetles are a real threat, place a ball to each ten plants. Re-moisten every evening if necessary.

In planting out, be careful to discard seedlings or beds infested with eelworm. Plants infested with stem borers should be discarded. Any leaf miners seen can be squashed *in situ* when the plant is set out, damaging the leaf as little as possible. Large sand crickets can be treated as described for October. If last season's tobacco lands are again to be planted, go over them a week or two before planting and remove and destroy any remaining regrowth; don't wait until planting out commences.

Cotton. Examine cotton lands to ensure that they carry no regrowth.

Potato. Leaf-eating caterpillars and the first brood of lady bird beetles damaging the potato crop may be controlled by treating with lead arsenate 1 lb. in 25 gallons water, plus spreader, or with other more or less insoluble arsenical dusts or sprays, or with certain fluorine dusts, or with the modern synthetic organic insecticides according to manufacturer's advice. The same sprays will keep down black blister beetles, which sometimes attack the crop on sandy soils. Tubers infested with eelworm should not be planted nor should eelworm-infested land be used for the summer potato crop.

Keep the soil well ridged and in friable condition as a precaution against egg-laying on the tubers by tuber moth.

Orchard. For fruit fly, chafer beetles, and scale see detailed October notes.

Garden. See garden notes for September.

In most agricultural pursuits, remember:—
"*Cleanliness Aids Insect Control.*"

PLANT PATHOLOGY.

Continue spraying tobacco seed-beds until time of transplanting. Wash hands frequently when pulling plants and transplanting. Remove bottom seed-bed leaves from early planted tobacco. Commence spraying the crop.

Spray potatoes as soon as the plants are a foot high and continue at regular intervals to prevent early blight.

Spray tomatoes with copper as soon as the first buds appear and repeat several times to control leaf blight. Take precautions against blossom-end rot, as in October, if weather remains hot and dry. Rogue out any plants affected by bunchy-top and wash hands frequently when planting and suckering.

In hot, dry weather add a level teaspoonful of Bordeaux powder to the soil round garden transplants to prevent foot-rot—especially antirrhinum, godetia, salpiglossis, and Barberton daisy seedlings.

Continue fruit tree spray schedule, especially if mildew appears.

BOTANY.

NO NOTES FOR NOVEMBER.

PASTURES.

Planted pastures, particularly of deep-rooted species, such as Napier fodder or Rhodesian Sudan, will afford useful feed in this month. Care should be taken not to graze them too closely.

The burning programme for the season should be completed by the end of the month. Do not graze new burns, particularly of sweet or mixed veld, until fair growth has been made, as early grazing tends to weaken and reduce the grass cover.

In the higher rainfall granite sand veld areas, cattle will tend to start leaving the vleiland pastures for the top veld, particularly if rains have fallen.

CONSERVATION.

1. (a) Inspect newly constructed contours and storm drains immediately after first rains to catch them *before* they break.

   (b) Strengthen weak spots in banks which may have been caused through settling of ground after rain.

   (c) Remove high spots in water channels while "water mark" can still be seen and while ground is still soft.

   (d) Look out for weakness caused by ant holes or holes made by vermin.

2. Some grass planting in gullies and badly eroded areas may be done in December if crop planting is well in hand and suitable rains have fallen.

3. Plant out poplar tree roots or cuttings in gullies and wet lands, also kudzu in holes prepared earlier.

4. Inspect grass strips and water-ways after first rains for any damage, and repair by building earth or sod diversion banks, designed to keep the water spread.

LIVESTOCK.

Beef Cattle. In the drier parts of the Colony this may still be a most critical month, and only continual supervision and very good management will pull the cattle through without heavy losses. Particular attention should be paid to thin cattle and cows due to calve. After a bad winter and late rains, there can easily be heavy losses among these. This is the time when a little extra feed, and in particular succulence, is worth its weight in gold. Watch water supplies carefully.

In the earlier rainfall parts good green grazing should be available and all the cattle should be doing well. The "maternity herd" should also be watched very carefully, as a calf lost is a future steer or cow lost. Give this herd the very best grazing nearby and see that every calf is born alive and reared well.

The last of the stall-fed bullocks will probably be sold this month.

Dairy Cattle. Again keep the cows in the pens if good green grazing is not available and continue feeding as during September and October. When there is ample green grass, pen-feeding will, of course, no longer be necessary, and the cows will be brought in twice daily for milking and concentrate feeding. Remember that high milking cows still require a liberal ration of grain, otherwise they will draw on their own bodies and later drop in production and a disappointing lactation will result. Heavy in-calf cows or heifers should be maintained in good condition and young heifers growing well. They should now do well on green grazing only if available, otherwise October feeding should be continued. Young dairy stock reared during the winter months should slowly be accustomed to green grazing.

Should heavy rains fall, see that the young dairy calves are kept dry in their pens. After 4 weeks allow them out on nice warm days for exercise and grazing in a small, clean paddock close by. In regard to accommodation, small, single pens are definitely the most satisfactory.

Sheep. The September weaned lambs should be doing very well and should be nearly ready for slaughter. On dry grass continue October feeding, but if green grazing is available, feed a few ounces of maize in addition daily.

Most of the ewes should have been covered by now, but it is safest to leave the rams with the ewes until the end of December. This will ensure a maximum lamb crop. In regard to the rams, it is a good practice to keep them at home and give them some supplementary feed during the day. Running them with the ewes from, say, 4 to 5 p.m. to 8 a.m. the following morning will be ample.

In the wet parts of the Colony keep the sheep away from vleis and run them on the high, dry parts. In these parts dosing should

now be regular and at fortnightly intervals, otherwise as for October.

Pigs. Much the same as in October. Be sure that they get green feed or good quality legume hay and sufficient carcase meal if sufficient separated milk is not available. Sows with litters should get not less than 2 gallons, weaned pigs 1 gallon, and baconers ½ gallon each per day for good growth.

DAIRYING.

Under the weather conditions which now prevail, cream should be despatched to the creamery at least three times a week and where possible daily deliveries should be made.

The separator cream screw should be adjusted so as to deliver a cream testing between 45 per cent.—50 per cent. A point well worth remembering is that organisms of all types in order to survive and multiply, require food in liquid form.

By separating a fairly thick cream during the hot and difficult dairy weather, the water content of the cream is reduced thus rendering the food supply available for bacteria too concentrated for rapid growth and multiplication.

Cans and buckets are the chief source of milk and cream contamination and the cause of many unnecessary second and third grade returns from the creamery. Many poor returns may be avoided if the sterilization of all dairy utensils immediately after washing is made a regular routine. Empty cans should be cleaned and steamed immediately they are returned by the creamery.

During the hot weather no detail in the production and handling of dairy products should be too small for the farmer's personal attention. As a regular routine, cows should be milked in clean surroundings and the milking site cleaned daily.

The cream should be cooled immediately after separation and stored in a cool dairy. During storage the cream should be stirred two or three times daily.

Warm and cool cream should on no account be mixed until both are at the same temperature.

The mechanical or oil burning refrigerator affords an ideal means of storing and keeping crea m cool. Warm cream fresh from the separator should on no account be stored in such a refrigerator until it has lost its body heat or until it has been passed over a surface cooler to liberate body and volatile odours.

Storing cream in refrigerators immediately after separation, has been the cause of many poor grade returns.

A safe rule to observe is to pass the cream over a surface cooler first, or allow three or four hours to elapse after separation before storing cream in the refrigerator.

VETERINARY.

If early rains have set in, occasional cases of Horsesickness may occur. Veld poison may still be expected, more especially if the rains are late. Deaths from Redwater may be expected to commence. White scour and sweating sickness in calves may be expected.

POULTRY.

All poultry houses should be examined and, if necessary, repaired before the rainy season. It is advisable to repeat the caution that poultry must have dry sleeping quarters. Moulting birds during this month should be culled, they are "moulting culls." Arrangements should be made for the disposal of all old birds in the laying flock to make room for the season's new pullets. The laying houses for their reception must be thoroughly renovated and cleaned. Repair all appliances and fittings, including trap-nests. The pullets should be drafted from range and settled in their permanent laying quarters as they reach laying maturity.

Egg prices begin to rise as a rule this month.

The most efficient net returns are obtained in flocks where 40 per cent. to 50 per cent. of the hens are replaced by pullets each year. Usually the average size of eggs is smaller and the culling percentage is greater in flocks containing a higher percentage of pullets; also the mortality is generally found to be less and the average return per hen is better. The best results are obtained in flocks having a pullet replacement of about 50 per cent. According to experience, the best practice is to select and keep the best of the hens for a second season's production and add 45 per cent. to 60 per cent. pullets each year.

Hens during their pullet year produce more eggs during the scarce period and a greater total for the year if the pullet moult is avoided, but they will lay a greater percentage of small eggs at the beginning of the season. Second season birds in the laying flock should be culled when they have completed their production at the end of the second laying season.

Culling should be somewhat a continuous practice with the poultryman. When a bird becomes unprofitable as a layer it is best to dispose of her at once. Usually many hens become unprofitable due to physical causes during the summer months. Culling should be rigorous during this time but should not be limited only to this season of the year. In large flocks there will be birds in every month of the year which should be culled. If this is practised it simplifies the final culling before the pullets are ready for the laying houses and it spells profit.

It is often found advisable to de-worm the pullets before removing them to laying quarters, as a precaution in areas where intestinal parasites are found to be troublesome.

Geese. When a few goslings are reared, the natural method will be found the best, with broody hens; but with large numbers the artificial method is advised. The eggs should be removed regularly as laid; the goose will then produce a greater number of eggs in the laying season. Goslings should be reared in the same way as ducklings. It is better to provide a fairly large wire netting enclosure with shade in which a number of broods could range, whilst the hens are confined in coops with slatted front and placed within the enclosure—the slats placed far enough apart for the goslings to leave or re-enter the coop. This keeps them under proper control and with protection day or night.

Turkeys. At this period of the year turkey raisers will have large numbers of young stock on hand. Some attention should be given to the selection of the future breeding stock before the Christmas sales take place. The best developed stock should be saved for next year's breeding before planning the disposals for Christmas. Select well-grown birds, having big frames, well adapted for meat production, with depth and breadth of body, uniformity in conformation, and well rounded body. The stock must be healthy, vigorous, and of good quality.

Incubation should cease until the wet weather is over. To rear turkeys in wet weather entails a good deal of labour and expense, often with excessive mortality. See that the turkeys are well fed and improving in condition.

DECEMBER.

GENERAL CROPS.

Keep the cultivators going, both on planted and unplanted lands, whenever weather permits. Destroy the weeds while young before they obtain a firm foothold. Turn your compost heaps on a wet day, after the top 6 ins. is wetted. Continue planting maize, beans and ground nuts as early as possible this month; followed by sunflowers, Sudan grass, manna, pumpkins, and cattle melons (do not plant pumpkins and melons *with* the maize where witchweed is present, as they hide the parasite from sight), linseed, Kherson oats, Teff grass, and S.E.S. oats. On beetle-infested land, sunn hemp should be planted after the other crops are in. Ensilage crops may be sown at the end of the month. When harrowing young maize, this work should be done in the heat of the day, when the plants are flaccid and not easily broken. On lands not yet planted, the weeds should be kept down by disc harrowing. It is a good plan to harrow or disc harrow immediately before the planter, or, alternatively, to follow the planter with a light harrow. A disc harrow can be used to cover the seed where maize has been hand planted, and thus speed the work, kill weeds, and stimulate soil bacteria. Treat seed oats and sorghums for smut before sowing. Treat ground nut seed with a mercury compound dust before planting. Keep a look-out for stalk borer, and top or otherwise treat affected plants. New lands and old pastures may be broken as circumstances permit during December, January and early February, and again ploughed from May to July. If they carry a heavy crop of grass, it should be mown for compost to enable good, clean ploughing to be done. Sweet potato slips should be planted early in this month. Every farmer should have a few acres of this valuable crop.

TOBACCO.

Continue preparation of land. The best results are obtained by transplanting on well prepared soil. Transplanting should be pushed on with as fast as transplants and climatic conditions will

allow. As soon as the plants begin to grow, go over the field and fill in all blanks with strong, selected plants, apply fertiliser to hasten growth and hasten early maturity. Cultivation should start as soon as the plants commence growing, especially on sandy soils. The crust caused by heavy rains should be pulverised by cultivation as soon as the surface soil is dry enough for tillage; this gives the young plants the benefit of the moisture stored in the soil. Do not neglect the late sown seed-beds. Make every effort to finish transplanting before the end of the month, so that the crop will be harvested before dry, cool weather begins.

FORESTRY.

Final preparations for planting should be made, including harrowing or pitting. Early plantings may be carried out if the season is a good one. Planting should be carried out on dull, rainy days, or, failing such days, late in the afternoons. Great care should be exercised in planting out to avoid bending the tap root, and to set the trees in the ground at the same level as they were in the seed-beds or trays. Late sowings of *Cedrela toona* seed may be made.

CITRUS FRUITS.

This is a good month to plant citrus trees in their permanent positions. They should on no account be planted deeper than they stood in the nursery. Water each tree immediately after planting it to settle the soil, then loosen the surface when sufficiently dry to check weed growth and restrict evaporation; continue loosening the surface soil after each rain then sow the cover crop and harrow also in two directions. If the grove is weedy it should receive a shallow ploughing in place of the discing. Then sow the seed and harrow the soil. All bearing trees must be kept well watered if the weather continues to remain dry. Trees that suffer for want of moisture while the young fruit crop is developing will be adversely affected, and the crop—if any—will be of inferior quality. Continue to rub off all water shoots or suckers which develop on the tree stems.

DECIDUOUS FRUITS.

Cover crops may be planted when the rains commence, as recommended under citrus fruits. Summer pruning may be commenced this month. If all undesirable shoots are taken out of the trees, the remaining shoots will receive sufficient air and light to mature. Ripening fruit must be carefully harvested, graded and packed if satisfactory prices are to be secured. Do not gather any fruit when it is wet. Keep all recently planted trees in good condition; the first year's growth is the most important. If the undesired shoots are rubbed off when they first appear, the retained shoots will receive all the nourishment and the tree will then grow to a large size.

VEGETABLE GARDEN.

All vegetable seeds may be planted. Advanced plants should be constantly cultivated. Potatoes should be ridged, and peas, beans and tomatoes staked. This is a good month for planting the main crop of potatoes.

FLOWER GARDEN.

This month is generally showery, and constant stirring of the soil is therefore necessary to keep it loose. Seeds of annuals for February blooms may be sown. Transplanting should be done in the evening or on a cloudy day. Carnations should be kept free from dead leaves and wood, and climbers attended to.

INSECT PESTS.

Maize. Before the new crop is up, remove volunteer or trap maize plants which have not been or will not be successfully treated against stalk borer, otherwise borer from them will later infest the crop maize. Infested volunteer or trap plants can be top dressed with such dressings as "Derrisol," according to manufacturer's directions, or 1 lb. sodium fluosilicate dissolved in 60 gallons water, or dry 2½ per cent. D.D.T. dust. The insecticide is introduced into the funnel-shaped cup formed by the young leaves. Several treatments may be necessary to kill successive batches of newly hatched caterpillars and stop them from boring down into the stalk and safety. Successfully treated trap crops may, of course be retained as part of the crop. Plants treated with poison should not be fed to stock.

Snout beetles, surface beetles and other insects which may reduce the primary stand, especially on red soils, may be baited as described for November. If volunteer or trap plants appear to be attracting and holding the large majority of them, the plants can be sprayed cheaply with a solution of 1 lb. of sodium arsenite (locust poison powder) to 10 gallons of water. This treatment will kill the plants as well as the beetles, and stock should not be permitted to get at the poisoned plants.

From now on, and throughout the wet season, keep a sharp look-out for army worm in its *young stages*, for in this stage control is easier and serious damage can be avoided. Rapoko grass and other sweet grasses in the neighbourhood of low-lying maize lands should be especially examined.

Tobacco. Continue seed-bed spraying as advised for previous months; continue the use of seed-bed cloth. There will probably be little need to use sand against small ants carrying away germinating seedlings if normal rains fall, as the trouble usually ceases with the advent of good rains. In any case, however, the sand coverings as described for September are stated to promote better germination and produce better transplants.

Follow the November advice for planting out. In addition, in non-planting weather make a point of going over disused tobacco lands to destroy volunteers and re-growth. *You will be too busy later.*

Keep down weed growth in the lands and clean a broad strip round the edges of the lands if grasshoppers are troublesome. This strip can be baited preferably when the soil is dry with the bait described for surface beetles (November), or with a "Gammexane" locust bait prepared by the method advised by the manufacturers. Persistent hand collecting on the lands helps.

Potato. Avoid using seed which is infested with pests, especially with eelworm. Do not grow summer potatoes in soil infested with eelworm. Potato soils should be kept friable to prevent cracking and to facilitate effective ridging which is necessary in tuber moth control. For ladybirds and other leaf eating insects attacking potato foliage, see November.

Sunn Hemp. Delay planting until after Christmas if possible, so as to avoid damage by sunn hemp beetles. Lands far removed from last season's sunn hemp lands can be planted earlier, but the beetles can travel some distance in search of a sunn hemp crop.

Orchard. See previous months with regard to fruit fly. Scale may be sprayed with proprietary oil sprays or resin wash.

Garden. Marrows, cucumbers, etc., are likely to be attacked by melon flies and should be sprayed as described in October notes for fruit flies. Collect and destroy all stung marrows, etc. Don't use D.D.T. on plants of this family.

In most agricultural pursuits, remember:—
"*Cleanliness Aids Insect Control.*"

PLANT PATHOLOGY.

Continue same operations as for November.

Keep sharp look out for leaf spot diseases in tobacco and take immediate action if any appear. Prime off all lower leaves with frog-eye infection and look carefully for first signs of *Alternaria.*

Spray apples and pears with copper to control bitter-rot.

Spray all vegetables with appropriate fungicides to control diseases generally. Look for mosaic in beans, and rogue affected plants if seed is to be kept.

BOTANY.

NO NOTES FOR DECEMBER.

PASTURES.

Good planted pastures will be especially valuable to dairymen during this month, as with proper management they can provide early grazing of high quality before the veld is at its best.

The final preparation of the seed-bed should be made for any grass to be sown. If fine-seeded grasses, such as Rhodes grass, are to be established, the two or three inches of top soil should be mellow and friable, and the soil below should be firm. An ideal seed-bed is obtained from a sunn hemp stubble by discing and drag-harrowing just prior to sowing. Sunn hemp stubble not only gives the ideal seed-bed, but it also affords a generous nitrogen supply, so important for the grass. Sunn hemp also suppresses weeds, which are the worst enemies to contend with in established pastures.

If grass roots are used, it is important to have the land clean and the soil moist to a good depth before planting.

All veld paddocks should be used at this time of the year and grazed rotationally to reduce selective grazing as far as possible.

CONSERVATION.

1. (a) Inspect newly constructed contours and storm drains immediately after first rains to catch them *before* they break.

   (b) Strengthen weak spots in banks which may have been caused through settling of ground after rain.

   (c) Remove high spots in water channels while "water mark" can still be seen and while ground is still soft.

   (d) Look out for weakness caused by ant holes or holes made by vermin.

2. Some grass planting in gullies and badly eroded areas may be done in December if crop planting is well in hand and suitable rains have fallen.

3. Plant out poplar tree roots or cuttings in gullies and wet land, also kudzu in holes prepared earlier.

4. Inspect grass strips and water-ways after first rains for any damage, and repair by building earth or sod diversion banks, designed to keep the water spread.

LIVESTOCK.

Beef Cattle. Even in the drier parts of the Colony good green grazing should be available by now, and beef cattle should require little attention except dipping and good supervision. In the low rainfall parts of the Colony cows are usually bred to calf-down from now on, and these, before and after calving, should receive all the additional attention which was recommended for such cattle during October and November. Even now the "maternity herd" should definitely be kept going, as it will enable the farmer to secure a maximum calf-drop and also spot all minor calf ailments as they occur. Dehorn and castrate regularly every 2 to 3 weeks. Dry cows and young stock should be doing very well, but if they do not, especially in the wetter parts of the Colony, the District Veterinary Surgeon should be consulted, as internal parasites may be the trouble.

Where ample feed is produced, or early spring grazing is available, bulls can now be put with the cows. Be sure that they are in good hard condition. Before putting them in, cull out all old cows, poor milkers, shy breeders, queen cows and poor type, unthrifty cows or heifers. These should not be bred, but sold as soon as they are fat.

On account of the wet weather and green grazing, bullocks are not stall-fed at this time of the year. In parts where early vlei grazing was available, steers should be in good condition by now, and "topping them off" by feeding 5-8 lbs. of meal daily on the veld has proved a very helpful and profitable practice.

Dairy Cattle. With green grazing at its best, milking cows should produce up to 2 gallons each per day off the veld, and as this

is the time of the year that we get our most economical produce, dairymen should see that the cows are always on the very best possible grazing. Grass growth will be very fast, and to keep it at its maximum feed value it will be necessary to have small paddocks so as to keep it grazed down by a proper system of rotational grazing. The mistake is often made to try and get too much milk off the veld without the feeding of grain. This should be guarded against, and high producers should get as much as they will require for their production above what they can get from the grass. Dry in-calf cows and heifers should now manage without any additional grain, but if any should happen to be in poorish condition they should be fed sufficient to make sure that they will calf-down in good condition. Young heifers should manage very well on the green grass, and dairy calves should be looked after as was recommended for November. Care should be taken that they are not left out in the rain or cold unnecessarily.

Sheep. The lambs should now be ready for sale, but if a few are not in sufficiently good condition they should be held back for another month if necessary. Usually the market is at its best a week or so before Christmas. In regard to the ewes, they should be looking very well, and all sheep should under no circumstances be grazed anywhere near wet vleis. They will do considerably better on the higher and drier parts of the farm. Dosing should now be very regular at fortnightly intervals, and at the end of the month the rams should be taken out of the flocks.

Pigs. There should be no trouble at all now to supply the pigs with all the green feed they require, and on most farms more than sufficient separated milk should be available. Care should be taken to see that the styes are kept clean and dry, as the pigs will soon suffer from rheumatism if they have to sleep in wet pens on concrete. In regard to dry sows these will, of course, be run in small paddocks, and it is an excellent idea to plough these up and harrow in maize and legumes broadcast at the rate of about 80 lbs. per acre. After a month or two there should be ample green feed for the sows, and the crop will at the same time keep the soil fresh.

DAIRYING.

Under the weather conditions which now prevail, cream should be despatched to the creamery at least three times a week and where possible daily deliveries should be made.

The separator cream screw should be adjusted so as to deliver a cream testing between 45 per cent.—50 per cent. A point well worth remembering is that organisms of all types, in order to survive and multiply, require food in liquid form.

By separating a fairly thick cream during the hot and difficult dairy weather, the water content of the cream is reduced, thus rendering the food supply available for bacteria too concentrated for rapid growth and multiplication.

Cans and buckets are the chief source of milk and cream contamination and the cause of many unnecessary second and third grade returns from the creamery. Many poor returns may be

avoided if the sterilization of all dairy utensils immediately after washing is made a regular routine. Empty cans should be cleaned and steamed immediately they are returned by the creamery.

During the hot weather no detail in the production and handling of dairy products should be too small for the farmer's personal attention. As a regular routine, cows should be milked in clean surroundings and the milking site cleaned daily.

The cream should be cooled immediately after separation and stored in a cool dairy. During storage the cream should be stirred two or three times daily.

Warm and cool cream should on no account be mixed until both are at the same temperature.

The mechanical or oil burning refrigerator affords an ideal means of storing and keeping cream cool. Warm cream fresh from the separator should on no account be stored in such a refrigerator until it has lost its body heat or until it has been passed over a surface cooler to liberate body and volatile odours.

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VETERINARY.

NO NOTES FOR DECEMBER.

POULTRY.

This is a good month for the disposal of stock for table. Fowls, ducklings and turkeys should be fattened for the Christmas demand. It pays to give them special attention in that respect.

The normal moulting season commences from this month. The duration of the moulting period of any given flock can be shortened and the average production maintained by the elimination of the early moulters that have stopped laying at this time of the year. The condition of the plumage is an indication whether individual birds are persistent layers or not. Hens which lay regularly retain their old plumage longest and are generally profitable for another year's production. The early moulters or low producers actually take much longer to complete their moult, they are longer out of production and slower to recommence laying; they are, in effect, unprofitable. These should be culled out now. Moulting birds which are still laying should be retained until they cease production.

A large number of poultry of all classes are transported to market during this month. The conditions under which they are despatched often leave room for improvement, both from the humane and the commercial point of view. The crates should be high enough to allow the birds sufficient head-room and sufficient floor space for the number and variety to be consigned. The birds should be protected by some light covering, for example, hessian,

attached to the sides and top of the crate, and well ventilated. Water vessels should be attached to the front corner uprights. The Railway regulations provide for the number of birds to be consigned in accordance with the dimensions of the crate; consignors should make themselves familiar with these regulations. The crates for fowls and ducks should be at least 18 inches high, for turkeys and geese 30 inches high; this enables the birds to stand upright without injury. Large crates are difficult to handle, convenient dimensions would be about 4 ft. long and 2 ft. wide. Good crating assists in maintaining the weight of the birds, especially when provided with food and water over long distances. The shrinkage in average weight of birds in transit is likely to be greater than normal unless the birds are comfortably crated.

This is a good month for the vaccination of pullets and other young stock as a precaution against fowl-pox. Another good stand by is the use of potassium iodide in the mineral mixture, as follows: Bonemeal, 50 lbs.; finely ground limestone, 23 lbs.; fine salt, 20 lbs.; sulphur, 5 lbs.; oxide of iron, 2 lbs.; potassium iodide, 4 ozs. Dissolve the iodide in a cup of water and sprinkle over fine salt, then thoroughly mix all ingredients; or, if desired, the iodide may be given alone. Dissolve 1 oz. potassium iodide in a bottle of water, and one teaspoonful of this added to one gallon of drinking water twice weekly. Or to every 100 lbs. of dry mash add 3½ lbs. of the above mixture throughout the year.

There is nothing more disappointing when egg prices are improving than to find the pullet flock has contracted fowl-pox, which is usually followed by a pullet moult with a much reduced egg yield. Prevention is better than cure.

Ducks. All the surplus ducks should be sold this month, retaining only the breeding stock. Duck raisers who produce ducklings throughout the year will find it necessary as the moulting season progresses, and when the old stock begins to moult, to select from the earlier incubations stock for breeding in place of the old birds. The young stock should come into production at six months of age and would be suitable for the production of table ducks during the first half of the year until the general breeding flock again comes into production. The mash for the old stock should consist of 50 per cent green food.

Turkeys. The turkey flock should be reduced in numbers to the requirements for breeding the following season, with the exception of the young poults, which, owing to their age, at present are unfit for market. These should be disposed of to the best advantage during subsequent months.

The young stock selected for breeding should meet the requirements for early incubations to be commenced late in the autumn. The natural time for the older stock to lay is during the early spring months. A laying mash, if fed to the breeding birds a few weeks before the time when incubation is due to commence, should bring them into production. Breeding pens should consist of six to ten hens and a male bird.

Turkeys cannot easily be kept on the semi-intensive system, but should either be given their liberty—on clean, fresh land—or reared, grown on, and fattened on the intensive system.

JANUARY.

GENERAL CROPS.

Turn your compost heaps on a wet day. Plough under, or one-way disc, witchweed traps within 2 months from germination. If only one trap is being planted, plant this month. If not already sown, put in the ensilage and fodder crops at once, such as maize and legumes; also Kherson and S.E.S. oats and other grass hay crops. Sow short-season crops like haricot beans, linseed, buckwheat, peas, summer oats, cowpeas and sunn hemp for hay. Plant out grasses and Kudzu vine for pasture. Ridge potatoes and cultivate thoroughly to kill weeds. Main crops can still be planted. Quick-growing green manuring crops, such as cowpeas and sunn hemp, may still be sown this month.

Earth up ground nuts so that a small amount of loose soil is thrown over the crowns of the plants. Cultivate all growing crops well, and thoroughly eradicate weeds. Overhaul all hay-making implements and ploughs, and put them in good repair in preparation for the haying and ploughing seasons. Prevent Mexican marigold and other noxious weeds in arable lands from seeding by hoeing or pulling out the plants by hand. Keep a sharp look-out for maize stalk borer in late plantings. Cut off the tops of infected plants or treat them with a recognised chemical. Watch the early-planted maize for witchweed. Prevent witchweed from seeding by cultivation, and by hand pulling the plants.

Make as much compost as possible by placing sunn hemp, grass and litter in cattle kraals, pig sties and stables. If there is stumping and clearing to be done, push on with it. The ploughing of virgin land should be done this month, if possible, in order to give the sod time to rot properly.

TOBACCO.

Cultivation should be systematically continued and no foreign vegetation allowed in the tobacco field, as weeds and grass induce insect attacks. All backward plants should be given special attention, and an additional application of fertiliser to hasten growth, so that the plants ripen as uniformly as possible. Curing barns should be placed in proper condition on rainy days, and all tobacco appliances should be placed in proper order for the rush of work during the curing season. Early planted tobacco may be ready for topping during the latter part of the month, and the common mistake of topping too high should be avoided. Go over the field carefully and select typical, uniform and disease-free plants for producing seed for next season's crop. All plants should be properly primed at the same time that the tobacco is topped.

FORESTRY.

If the rains are reasonable, plant out evergreen trees such as gums, cyprus, pines, etc. Fill in all blanks as soon as they are noticed and do not leave them until the following season. Planting should be done on a wet day, or, failing that, on a dull day or

late in the afternoon. Great care should be taken to see that the trees are not planted out any deeper than they stood in the tins and that the roots are not bent.

CITRUS FRUITS.

The planting of citrus trees should be completed if possible by the end of the month, for trees planted later may not harden up before the winter; they become susceptible to winter injury from cold. This month is the best one for planting shelter belts to protect all varieties of fruit trees from the prevailing winds. Cover or green crops may be planted during this month; if the grove has been over-run with grass or weeds, sow the cover crop seed more thickly. This will assist in smothering future weed growth. Continue suppressing any undesirable shoots that may develop on the tree trunk or other parts of the tree. Drain any depressions that allow rain or irrigation water to accumulate at the base of the trees, for trees permitted to stand in water will speedily fall victims to disease or pest injury.

DECIDUOUS FRUITS.

Continue planting cover or green crops between the trees. These crops may then be turned under towards the end of the rainy season to furnish the necessary humus.

Summer pruning may be continued. Rub or break out any undesirable shoots that have a tendency to crowd each other; suppress all growths on the main stem from the ground level up to the main arms of the tree, for these are unnecessary. If next year's crop is to be of good size and quality, the inner fruiting wood of a tree must receive sufficient air and light to mature fully. If the new growth is too dense it will prevent the fruiting wood from maturing, and poor crops will be the result. The thinning out of the summer growth will overcome this crowding and weakening of the fruiting wood.

Many fruits will be ripening during the month. Do not permit the fruit to become over-ripe on the trees; rather harvest it at the correct stage and store or sell the surplus.

Plant shelter trees if the orchard is exposed to the prevailing winds, as good crops of fruit cannot be expected from inadequately protected fruit trees. Stake young trees if necessary.

VEGETABLE GARDEN.

Swedes, turnips, carrots, cabbages, cauliflowers, lettuces, etc., may be sown for carrying on during the winter months. Potatoes may be planted this month for keeping through the winter. Weeding and cultivating between the rows should be continually carried on. Green beans may be planted every three weeks until May.

FLOWER GARDEN.

This month requires all one's energy in the flower garden. Summer annuals, such as zinnias and marigolds, may still be sown for late flowering before the season is over. Planting out should be done as early as the weather permits, and advantage taken of

a dull day after a shower for this work. If care be exercised, much smaller plants may be put out than would at first be thought advisable, as with attention these will make stronger plants than larger ones, which are more likely to receive a check. The soil requires constant stirring, owing to the packing caused by the rains and for the eradication of weeds, which are now very troublesome. All plants should be kept free of dead and decaying matter.

When obtainable, roses may now be planted. Keep well shaded for a few days.

INSECT PESTS.

Sending specimens. Unless the identity of an insect pest is known without doubt, enquiries on its control should be accompanied by specimens of the insect and descriptions or specimens showing the damage caused. Whether these are despatched by post or by rail, the carriage should be prepaid by the sender.

In general, live specimens are preferable. If they are active, individuals should be placed in separate containers to prevent their destroying one another. Large insects should not be packed in impervious containers such as tins, unless they are well ventilated. They can be placed singly in small cardboard boxes within a larger box. Caterpillars and other voracious insects may have a little of the food plants packed in with them. Smaller insects can be placed in match boxes enclosed in a cigarette box. Living specimens of soil-inhabiting grubs, etc., should be placed singly in match boxes which are then filled to the brim with loose practically dry soil, and closed. A few additional specimens of soft bodied insects can be forwarded in spirits or brandy. Specimens of plants showing damage can be rolled in newspaper or packed between paper sheets in a flat cardboard box.

The above are not inviolable rules but guiding principles. Insect specimens should be addressed to the Chief Entomologist, P.O. Box 387, Salisbury, or brought to his laboratories in the Borrowdale Road.

Maize. Early in the month destroy any remaining volunteer or trap plants which have not been successfully treated against stalk borer. Infested plants can be top dressed as described for December, but if earlier precautions have not been taken and the infestation is severe and recent, it would be better to top dress the whole crop once, and follow up later if necessary by treating only infested plants. Infested plants up to about six weeks old, however, may be cut off just below the lowest point of attack and carted away; if the caterpillars have already entered the stalk this is the only economical treatment. The cut-off portions must be well removed from the fields owing to the danger of the caterpillars migrating to other plants. In badly infested areas it is advisable to plant a trap crop now in order to have it at a more attractive stage than the main crop when the second generation of moths appears. The plants can finally be used for ensilage.

Other pests attacking the seedling maize at this time include snout beetles and surface beetles, direct control measures against

which should have been initiated, if necessary, in November and December (q.v.). If replanting is indicated on account of these pests, and if it is not too late, plough the crop well under and bait the land before the new crop comes up.

The black maize beetle is a pest in vlei soils in some districts. Hand collecting the adults has been found to be both economical and beneficial. Other control methods can be carried out in winter of which particulars will be given on application.

Keep a sharp look out for young army worm (see December).

Tobacco. See seed-bed and transplanting notes for November and December. The destruction of seed-bed plants as soon as they are no longer wanted for transplanting is required by law. As soon as all seed-beds have served their purpose, thoroughly clean out the spraying equipment used on them, whether you intend to do field spraying or not.

Plants in the field infested with stem borers, and primings infested with leaf miners, should be destroyed. Suspected plants found to be infested with eelworm should be moved from the land and destroyed. Observe clean culture. Bait or hand collect grasshoppers as in December if necessary. For preventing attack by false wireworm, see April. Budworm should be collected by hand during topping operations. Bagged seed-heads should be examined weekly and the worms destroyed.

Potato. See November. Keep ridges in good condition, breaking the surface of the soil when it has dried after rain.

Legumes. The stem-maggot fly may attack haricot beans and cowpeas but will not attack velvet beans, jack beans, nor dolichos beans. Beans and cowpeas infested with another stem insect, the bean stem weevil, should be uprooted and destroyed to prevent the breeding of these beetles. They are a minor pest in the kitchen garden but attack is occasionally severe.

Insects chewing the leaves of beans, notably small yellow or yellow and blue beetles, may be controlled if sufficiently numerous by spraying with 1 lb. lead of arsenate to 30 gallons of water plus spreader or probably with the new insecticides. Blister beetles (e.g. C.M.R. beetles) attacking the flowers should be collected by hand or a net and destroyed. Collections need to be made for several days in succession, preferably in the early morning, before a diminution is noticeable. Dusting with 5 per cent. D.D.T. powder is said to control these beetles.

Sweet Potato. The caterpillars of sweet potato sphinx moth may attack the leaves. They grow to a large size and should be collected by hand. Keep an eye open for sweet potato weevil, which is a slender snout beetle which resembles a large ant. It may be seen on the stems, especially near the roots. It renders the tubers useless. In second-year sweet potato lands it may ruin the whole crop of tubers. Write for advice and send specimens if they are found. Don't be misled by a short, stubby, brown snout beetle which feeds on the leaves.

Garden. See previous months for miscellaneous pests.

Turnip plants infested with the caterpillar-like larvae of saw-flies may be dusted with a mixture of 1 lb. Paris green and 20 lbs. fine slaked lime or flour, or sprayed with lead arsenate and spreader. This treatment is also effective for flea beetles.

For melon fly on melons, cucumbers, and marrows, etc., follow treatment for fruit fly on fruit, described for October. Do not use D.D.T. on these plants.

Orchard. See previous months.

In most agricultural pursuits, remember:—

"Cleanliness Aids Insect Control."

PLANT PATHOLOGY.

Continue as for December. Keep tobacco free from frog-eye and if barn spot develops, prime affected leaves in the lands.

BOTANY.

With good early rains young Upright Starbur plants will appear this month. Efforts should be made to remove or kill them before they set seed. Spray with DNOC. (2 - gals. of commercial paste to 100 gallons of water for one acre of Starbur) or remove by hand and burn all young plants.

PASTURES.

The grass planting programme, whether of seed or roots, should be completed this month or early in February at the latest.

Hay-making equipment should be put in good order, and essential spares obtained to avoid unnecessary delays after cutting commences. Close to grazing fields which are to be cut for hay that season.

The veld is at its best in January, so planted pastures can be reserved for hay and used later in the season.

CONSERVATION.

1. Plant grass in gullies and badly eroded areas.

2. Plant trees for conservation purposes and wind-breaks.

3. Check up on old and new contours and storm drains for any damage caused by heavy rains.

4. Inspect grass strips and water-ways for any damage caused by excessive rains and repair if necessary.

LIVESTOCK.

Beef Cattle. In the high rainfall parts of the Colony bulls will, of course, now be with the cows. Be sure that they remain in good, hard condition for the service season. If necessary, give them a few pounds of concentrates daily. In the drier parts of the Colony calving should still be in full swing. All the cattle should be looking well, but the "maternity herd" should still be kept going and given all the possible additional attention. Remember once more that every calf lost is one less bullock or cow a few years later.

This season's spring calves should be looking very well by now, and in parts where dairy ranching is practised, care should be taken not to overmilk the cows and let the calves suffer. Calves should be regularly dehorned and castrated at from 2 to 3 weeks of age. On farms where bullocks are being fattened on the grass by giving them a little grain in addition to the grass, approximately 5-8 lbs. of meal should be fed per steer. Fat bullocks should be coming in off the early vlei grazing and catch the high January prices.

Especially during the wet season screw-worm should be watched for. Without a wound, there can be no screw-worm. As 90 per cent. of all wounds are caused by ticks and horn pokes, the sensible thing to do is to eliminate these.

Dairy Cattle. Grazing should still be excellent, provided it is so managed that it is not getting too rank. Production should, therefore, still be cheap, and it should not be difficult to get 1½ to 2 gallons off the grass. Higher producing cows should, however, definitely be fed additional grain according to production, otherwise they will simply draw on their own systems and go off in condition and production a little later on. An excellent mixture for this purpose and at this time of the year is one consisting of 3 to 4 parts of maize meal and 1 part of groundnut cake. All in-calf cows and heifers as well as young stock should be doing very well. If not, consult the Veterinary Surgeon, as internal parasites may be the cause. Do not forget to make sure that the small calves have a clean, dry shelter and are not allowed to remain out in the wet and rain.

Sheep. Management will be very much the same as during December and all sheep should be grazed well away from vleis and other wet parts. At this time they usually suffer from internal parasites, and dosing should be continued with very regularly at fortnightly intervals according to veterinary instructions.

Pigs. As during December. Now, too, ample supplies of green feed and separated milk will be available and the pigs should be doing exceptionally well.

DAIRYING.

Under the weather conditions which obtain, cream should be despatched at least three times a week. It is of the greatest importance that cream should be cooled immediately after separation, and should be kept cool while on the farm, and whilst in transit to the railway station. It is desirable during this season of the year to make use of the cream surface cooler, which is supplied with a water bag for cooling the water, which is passed through the cooler. Immediate reduction in temperature is obtained by this method of cooling, and the results achieved are well worth the money expended on the purchase of the cooler.

Warm freshly separated cream should not be mixed with cold cream until both are at the same temperature.

Gassiness and over ripe returns are frequently received during this period of the year. These undesirable fermentations may be kept in check by personal supervision of all stages in production,

such as the washing and sterilization of the dairy vessels; careful and sanitary milking and the provision of adequate and clean drinking water for the cows.

VETERINARY.

Tick borne diseases — Redwater, Gallsickness, Heartwater and Theileriosis may be expected. Horsesickness, Bluetongue and Lumpy Skin Disease may occur especially if there have been early rains.

POULTRY.

Moulting will be fairly general during this month—fowls, ducks, and turkeys. It will be evident on observation of the laying flock this month that some birds will have a mixture of new and old feathers, they are moulting gradually section by section, but still laying; and with others there will be little, if any, evidence of moulting. These are said to be the late moulters. It is not unusual during the late autumn to find in well-managed flocks a number of birds almost bare, losing all their feathers in quick succession before the winter sets in, the best producers still moulting before their egg production ceases. The gradual and late moulters remain in production until late autumn; they have laid heavily for twelve months and more, when they renew their feathers quickly after a short break in production, when almost immediately these hens are ready to recommence profitable production for another season. The early moulters in the adult laying flock should be culled out early before the normal moulting season begins.

Generally speaking, when adult fowls are kept in full lay, moulting is delayed to some extent beyond the normal season. The later a hen commences to moult when her production ceases, the longer will be her laying season, and hence the greater will be her egg yield and the profitable results.

The management of the flocks, the pullet flock, adult flock and the breeding flock in relation to the moult, all require special attention. It pays to grasp the essential requirements in each case. Obviously, moulting of the pullet flock must be avoided. Moulting and a rest for the breeding stock must be encouraged; and the commercial laying flock of adult stock partly encouraged to moult and partly delayed. The pullet flock is sensitive and temperamental, and without satisfactory management would be susceptible to a complete or partial moult, but only during the first three or four months of their coming into production. That is the critical period for them; forcing their egg production must be avoided; they have reached productive maturity and they have still to mature physically. It is obvious from this they have still to grow and fill out when producing eggs. Their plump condition must be maintained by suitable feeding, especially the early-hatched pullets; these are more susceptible than the later hatched. A greater proportion of grain than mash during this critical period would suit them best. The annual routine is to have all the pullets settled in their permanent laying quarters as they reach the productive age by the end of March. Avoid overcrowding the laying houses, and the food hoppers must be adequate for the size of the

flock. Individual birds must have a fair chance to feed without undue molestation. Avoid drastic changes in their diet. Avoid rough handling and frightening them; handle them quietly. Hygienic conditions minimise disease and parasitic vermin.

The breeding flock, on the other hand, should be given special treatment from the months of January and February each year with a view to forcing a moult in preparation for the breeding season. This applies to the old breeders and the young selected breeders after their recording period, which should by now be terminating. They have been productive for a year, and restricting their egg production would enforce a moult. Their moulting must be completed before they are required for breeding. The best results in hatching, and strong, healthy chicks, can only be expected from stud stock in fit breeding condition.

The best of the young hens which are completing their first laying season—from these the breeding birds have been selected—should be kept in production until about April, when a general moult is enforced on them. By this time the average production of the pullet flock should be satisfactory.

The birds which are completing their second laying season should be given special treatment to stimulate the maximum production with a view to disposal of this entire flock when the moult is well established. An increase in the amount of meat meal—5 per cent. to 10 per cent.—from December or January, is recommended to obtain the greatest production of eggs when egg prices are high. It means additional profit until the moult becomes established late in autumn.

FEBRUARY.

GENERAL CROPS.

Continue the recommendations for January. Potatoes and ground nuts will probably need ridging again. Catch crops of the quick maturing tepary bean and buckwheat, and also Pearl millet for late grazing for dairy cows, can still be sown. Keep down all noxious weeds. This work can be carried out on wet days. Keep potatoes in a cool shed, well ventilated. Pick over any potatoes in storage and remove bad ones. The early irrigated potato crop can be planted early in the month. The second trap crop of two for witchweed control can be sown, and will then be ready for ploughing down in April, when the soil is in good condition for the work. Keep a sharp watch for witch weed in maize lands.

TOBACCO.

The early tobacco should now be ready for curing. Care should be taken to select only thoroughly ripe leaf for filling the barns, so that the cured product will be uniform. Topping, priming and suckering should be given attention. Selected seed plants should be carefully watched. New land intended for tobacco next year

should be ploughed this month, so that all organic matter turned under may be converted into humus before planting time next season.

Turkish Type. The work of preparing curing racks and storage accommodation should be completed as soon as possible.

FORESTRY.

Tree planting operations should be carried out on dull, showery days or late in the afternoons. Take care in setting out plants, avoid bending the roots and do not plant deeper than the plants were in the seed-beds or trays. Seed-beds or trays should be well watered just prior to planting. Steps should be taken to prepare seed-beds for the slower growing species, i.e., pines, cypress and Callitris.

CITRUS FRUITS.

Newly planted citrus trees should be kept free of weed growth likely to exclude necessary air and light for their normal and health development. The early planted cover crops will be fit to plough under by the end of the month. Do not delay this operation for fear of the rains ending abruptly. If this occurs, great difficulties will be experienced when attempting to plough in the green crops. Keep all young shelter belt trees free of weed growth, and loosen the soil round their stems fairly frequently to eliminate possible ant injury. This is one of the best months for budding citrus trees, either in the nursery or grove-trees that are to be top worked to profitable varieties. Late out-of-season fruit that may have set during December-January should be stripped from the trees. If allowed to mature, it may affect the main crop setting of fruit.

DECIDUOUS FRUITS.

When sufficiently mature, plough under cover crops. This should be possible towards the end of the month.

Summer pruning should be completed early in the month: little or no advantage will be derived from trees treated when the new wood reaches maturity.

Do not allow fruit to become over-ripe, then expect remunerative prices for it. If it is harvested at the correct stage, then well graded and neatly packed, good prices may be expected for the surplus fruit sold.

This is a good month for budding deciduous fruit trees.

VEGETABLE GARDEN.

Sow now: Beans, beet, cabbages, cauliflowers, lettuces, peas, onions, carrots, parsnips, turnips, endive, kohl rabi, rhubarb and all herbs. Collect all grass and vegetable refuse for making compost.

FLOWER GARDEN.

Sow Iceland poppies, carnations, phlox, pansy, verbena, gilias, larkspur, dianthus and pentstemon. The flower garden should be

now looking at its best, nearly all plants being in bloom. Old and dead flowers should be constantly removed, except when the seed is required. Seeding of the plants shortens their flowering period. All runners and climbers should have constant attention, and be tied up and trained, otherwise they will be damaged by the wind. Dahlias, chrysanthemums and carnations will require staking, as they become top-heavy when in flower. Make the first sowing of winter-flowering sweet peas. Finish budding rose briars.

INSECT PESTS.

Maize. The first brood of stalk borers matures during February and the young of the second brood may be found on young leaves, and more particularly so on young maize plants such as are grown for ensilage. Watch these young plants and also any wintersome present, as these make good trap plants for the second brood of borers. If they become badly infested they have probably done good work in preventing heavy second-brood infestation of the main crop. If they are to be used for ensilage, they will greatly reduce stalk borer carry-over for next season.

Keep down weeds in maize lands.

Tobacco. Don't neglect to destroy those seed-bed plants. For field pests, see previous months.

Potato. Maintain a good unbroken surface on ridges, with no tubers exposed. See previous months for leaf-eating insects.

Garden. See previous months. In general, insects chewing the leaves are killed by standard poisons such as Paris green or lead arsenate or the less soluble fluorine compounds, and aphis is controlled with tobacco extract; but precautions must be taken against the danger of humans or stock consuming poisoned foliage.

In most agricultural pursuits, remember:—
"*Cleanliness Aids Insect Control.*"

PLANT PATHOLOGY.

Maintain precautions against leaf spot diseases in tobacco, especially frog-eye and Alternaria, as in preceding months.

A further light dusting with Bordeaux powder to the soil around flowering plants will assist in preventing root-rot.

Continue the routine spraying of vegetables with suitable fungicides.

BOTANY.

This is the month when tobacco farmers should look out for *Striga gesnerioides*, Vatke (= *Striga orobanchoides*, Benth.) on their field tobacco crops. This is a parasite on the roots of tobacco belonging to the witchweed family and having the general appearance of mealie witchweed, although it differs, in that the flowers are pale mauve instead of red.

Its occurrence is only sporadic so far in Rhodesia; it is therefore of great importance that growers recognise it and hoe it out

before it sets seed. In the early stages of infestation this is quite a simple and effective method of control and should prevent the parasite from becoming a really serious pest on tobacco.

PASTURES.

Hay cut early in the season is a valuable feed. Besides having a higher protein content, it is more palatable and digestible than hay cut when the grass is more mature. Take advantage, therefore, of fine weather to start hay-making operations and store the hay under cover or in carefully made stacks.

In sweet and mixed veld areas, paddocks required for autumn and winter grazing should be closed to stock this month.

Pastures planted from roots earlier in the season can with advantage be cultivated to destroy weeds and loosen the soil. Every effort should be made to get the grass covering as rapidly as possible.

CONSERVATION.

NO NOTES FOR FEBRUARY.

LIVESTOCK.

Beef Cattle. These should be doing and looking well all over the Colony. In the high rainfall parts calving should be finished and in the drier parts it should be tapering off. Cows with calves should continue to receive very good attention so as to avoid losses and ensure that they do really well. Dehorning and castrating should not be neglected. Screw-worm cases should be guarded against and watched.

Steers to be sold off the grass in a month or two should be well looked after and kept on some of the best grazing.

In the drier parts of the Colony and on farms where no early green grazing or feed is available, the first of March is a good time to put the bulls to the cows. Now is, therefore, the time to go through the entire cow and 2-3-year-old heifer herds and cull severely as was suggested for December. Cull cows should under no circumstances be bred, otherwise they will again calve down the following season and never be fat for sale. Run all the culled females away from the bulls and sell them as soon as they are fat. Also go through the bulls and see that they are in proper trim for the service season. Undesirable ones should also be thrown out.

Dairy Cattle. These should be managed along the same lines as was recommended for January. The grazing should be watched very carefully. If it is getting rank and going off in feed value, production will drop. To prevent this, extra concentrates should be fed. Dry cows and young stock should continue to do well and calves should be properly housed and reared.

Sheep. Towards the end of the month ewes will commence lambing, and things should be so arranged that they will get the necessary attention. See that big udder ewes are carefully handled. Dosing should be continued with regularity and the sheep kept away from vleis and other wet parts.

Pigs. With ample supplies of separated milk and greens, all pigs should be looking very well. If in doubt, make sure that a properly balanced ration is being fed.

DAIRYING.

NO NOTES FOR FEBRUARY.

VETERINARY.

Horsesickness and Bluetongue may increase. If dipping of cattle has been systematically carried out, tick-borne diseases should be decreasing, but if dipping has been neglected they will continue and even increase.

POULTRY.

The planning of farm work is of major importance, and it has been established by experience that the greatest rewards in farming have gone to those whose operations are well planned. There is no more frequent cause of failure on the poultry farm, whether large or small, than procrastination—delaying to plan for the future. Planning with paper and pencil is a job which many dislike—psychologically, in effect—more than anything else, but, on the contrary, it is most interesting and should be tackled with the greatest enthusiasm. Plan well and have a good knowledge of the progress of your business.

This is a good time of the year to consider exactly what you are going to do, to consider not only the work to be planned ahead but also reflection on what has taken place during the previous season with a view, if possible, to improvement, pays. One cannot do better than benefit by past experience, chiefly in avoiding mistakes that could have been avoided. Most of the work can be done quickly, cheaply and most effectively, if it is done at the proper time. Haphazard methods soon lead to disappointment and loss, and if we are really going to make a success of our business we must work on methodical, economical and labour-saving lines. In ordinary circumstances it is advantageous to make your plans well in advance. To-day, with the many difficulties and problems that beset us, it is absolutely vital to success. If your programme for the year has not yet been planned, do not shirk it.

The very first thing to do now is to prepare for the breeding season. In spite of the food situation, this must have attention, for the breeding stock represent the foundation of your future prospects. Those who replace their laying flocks by the purchase of day-old chicks must give the supplier due notice. It will be obvious that if we are to expect our chicks just when they are required they must be booked early to save disappointment, as it enables the supplier to make arrangements accordingly. You will have the satisfaction of knowing that your order has been placed safely, and

find that it has taken a load off your mind. You will be able to commence preparations for the arrival of the chicks in better spirit, resulting in better work. Make sure purchases are made from reliable sources and that the brooding equipment is ready for the reception of the chicks on arrival.

The breeding birds must be moulted and selected in time for re-penning them. This is the best time of the year for dubbing and de-spurring the male birds. The breeding houses and runs must be renovated and cleaned; all vacant runs should be dug over and cropped during the rainy season to freshen them and remove taint. Cropping the runs with sunflowers will provide shade and green food in the runs for the breeding or laying birds during March, April and May. Incubators must be fumigated. Prepare for any additional construction; this must be done well in advance and completed on time.

Reference has been made earlier in these notes to the pullet moult. With early-hatched birds a certain number of pullets are liable to go into a neck monlt, particularly in adverse environmental conditions; far too many birds are allowed to moult when by careful observation and feeding it might have been prevented.

Early hatched birds usually come into production with a good flush of eggs, and unless their body weight is maintained, they are likely to moult. Refer to Bulletin No. 1394 in regard to the management of the pullet flock.

To be successful, one must study the stock and work for improvement. Apply good methods to all phases in the management of a poultry farm and attend to details. Equal in importance is the application of businesslike methods, ready to take advantage of favourable opportunities and prompt to avert mishap.

The good business poultry farmer is always striving for a complete knowledge of the industry. He knows when to hatch for autumn-laying pullets and when to hatch to catch the best demand for table poultry. It is a good thing to know when to market your produce, whether eggs or table poultry, to the best advantage. The poultryman in business on a large scale and buying all or most of the poultry feeds should know when to lay in a stock of foodstuffs.

Successful poultry farming is determined by those engaged in the industry maintaining the stock in a healthy, vigorous condition, and the productivity of the stock on a satisfactory basis by minimising disease and mortality. Hygienic principles must be adopted.

It is necessary for poultry farmers to organise effectively the marketing side of the industry and then by concerted action to produce and market economically the desired quality of marketable products. The poultry business includes three quite distinct

lines of operation: (1) Producing; (2) preparing the saleable products for market; and (3) marketing to the best advantage. Marketable products must be clean, attractive and of good quality. They should themselves be a good advertising medium to consumers. Eggs and table poultry are valuable foods and necessary articles of diet in every home; they are in demand throughout the world.

The increasing recognition of commercial poultry farming and the established importance of this industry as a source of a monthly cheque, as well as a valuable source of food production for human consumption, is evidenced by the remarkable progress which has taken place constantly in adverse as well as prosperous times.

Particular attention must be given to correspondence—replying to customers' letters promptly. A good business man is a good salesman. Keep accurate records and accounts.

Quarter Evil, Anthrax, Scab in Sheep and Foot and Mouth Disease are non-seasonal and should be watched for all the year round.

Southern Rhodesia Veterinary Report.

APRIL, 1947.

General. Cattle are in good condition in all districts except Bulawayo and Fort Victoria, where water shortage appears to be the greatest difficulty. This condition is almost certain to occur in Salisbury district as time goes on in the areas to which large numbers of drought relief cattle have been moved. The District Veterinary Surgeon, Umtali, draws attention to this position on some of the farms in his area. 8,950 drought relief cattle were distributed from Salisbury during the month.

Tick Life is active in nearly all areas where dipping can only be carried out to a limited extent on account of a shortage of water.

Dipping. The new Gametox No. 2 dipping fluid is being tried out in three tanks, and is giving evidence of being successful. Unfortunately the testing of the fluid in the tank is complicated and this is making it very difficult to maintain the tanks up to the required strength. Good reports have been received from cattle owners who have used the dip in addition to the usual arsenical fluid.

Diseases. African Coast Fever. No extensions of this disease were reported and no deaths have occurred on the infected farms. The District Veterinary Surgeon, Melsetter, reports on the cleanliness of the cattle in the infected area.

The dipping tank on Reitvlei was filled with Gametox No. 2 dipping fluid at the beginning of the month and three-day interval dipping was enforced instead of five. Reports to date show that it is very effective and the shorter interval of dipping must have a considerable effect on cutting short the deaths from the disease.

Anthrax. No fresh centres of infection were diagnosed and the inoculations were completed in the centre reported last month.

Trypanosomiasis. Only two cases were reported from the Chipinga area.

Lumpy Skin Disease. Infection was diagnosed on two farms in Salisbury district, on one of these farms two animals that were infected in 1946 again contracted the disease.

Infection was found on one farm in Lomagundi and at a number of kraals in Gutu Reserve.

Theileriosis. Cases were diagnosed, Salisbury district 7, Lomagundi 4, Mazoe 1, Fort Victoria 3.

Piroplasmosis is still on the increase owing to movements for drought relief and lack of dipping facilities. Fifty-three cases were reported.

Anaplasmosis. Similar to above, sixty cases being recorded.

Quarter Evil. Nine outbreaks; 1 Bulawayo, 7 Salisbury, 1 Fort Victoria. These have been controlled by inoculation.

Malignant Catarrh. Ten cases were reported on a farm in the Chipinga area.

Arsenical Poisoning accounted for 28 deaths on a farm in the Salisbury area.

Mallein Test. 100 horses were tested with negative results.

Tuberculin Test. 24 bulls, 21 cows and 11 heifers were tested with negative results.

IMPORTATIONS.

Union of South Africa: 65 bulls (breeding), 32 cows and calves (breeding), 41 horses and mares, 51 geldings, 2 pigs (breeding), 142 sheep (slaughter), 107 sheep (breeding).

EXPORTATIONS.

Union of South Africa: 2 horses and mares.

Northern Rhodesia: 158 cows and calves (breeding), 1 gelding, 736 sheep (slaughter).

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage.

Overseas: Beef 60,026 lbs.

Union of South Africa: Beef 348,050 lbs., ham 16,555 lbs., offal 4 lbs.

Northern Rhodesia: Beef 528,614 lbs., bacon 15,022 lbs., ham 4,089 lbs., offal 23,021 lbs., pork 17,582 lbs., fat 313 lbs., sausage casings 61 lbs., rolls 4,150 lbs.

Bechuanaland Protectorate: Beef 7,308 lbs., bacon 112 lbs., ham 48 lbs., sausage 263 lbs., ham 29 lbs., offal 144 lbs.

Portuguese East Africa: Offal 6,680 lbs., pork 7,802 lbs., mutton 7,405 lbs., fat 654 lbs.

Belgian Congo: Beef 432,653 lbs., bacon 880 lbs., ham 2,289 lbs., sausage 38 lbs., offal 29,063 lbs., veal 7,940 lbs., pork 1,809 lbs., poultry 510 lbs., mutton 571 lbs.

Meat Products from Liebig's (Rhodesia) Ltd., West Nicholson.

Union of South Africa: Corned beef 121,500 lbs., Ideal Quick Lunch 24,600 lbs., lunch rolls 4,728 lbs.

Sierra Leone: Corned beef 2,232 lbs.

Belgian Congo: Corned Beef 10,800 lbs.

United Kingdom: Extract o.f. 54,041 lbs., extracted beef residues 19,975 lbs.

P. D. HUSTON,
Chief Veterinary Surgeon.

MAY, 1947.

General. With the advent of cold weather cattle are beginning to fall off in condition.

Tick Life is now on the wane, but, owing to a shortage of water which renders dipping impossible in some areas, the usual decrease noticed at this time of the year is not so much in evidence.

Movements from Drought Stricken Areas. During the month 3,638 head of cattle were distributed from Salisbury, and, already by the end of the month, doubts are being expressed in some districts to which drought relief cattle have been sent as to whether the water supplies will hold out; Headlands, Rusapi, portions of Lomagundi and South Salisbury are probably the worst.

Disease. African Coast Fever. No deaths from this disease were reported from Chipinga or Melsetter, but a suspected case was seen on the farm Vooruitzicht in an animal that was slaughtered for beef. Smears submitted to the Director of Veterinary Research did not confirm the disease.

A fresh outbreak was confirmed on the farm Highlands in the Salisbury South area. There are 108 head on the farm and 65 head from Mayfield and 194 from Newhaven are dipping at the tank on Highlands. The area has been cordoned off and all movements stopped. One death occurred on the 7th, and no further cases were recorded up to the end of the month. This farm was infected in the 1939 outbreak, the last case on the farm being February, 1940, and the last case in the area being August, 1941. The area was released from quarantine in August, 1943. No explanation of how the disease was brought there can be given, and, as the carry-over was four years, it makes one suspicious of a breakdown in a salted beast from the previous outbreak. It is known that at least two animals recovered in the 1939 outbreak.

The new dipping fluid Gametox No. 2 is being used in this tank and three-day dipping is being enforced; so far reports are that it is very satisfactory. The strength of the tank is being maintained at 10 lbs. to 800 gallons of water, because experience has shown that 10 lbs. to 1,000 as recommended by the makers is not strong enough. The increase in strength has had no ill-effect on the cattle.

Anthrax. Only one outbreak occurred on a farm in Salisbury District. There was one death and 187 head were inoculated.

Trypanosomiasis. Four new cases were reported from Chipinga area.

Lumpy Skin Disease. A few mild cases seen in Gutu Reserve and two fresh outbreaks in Lomagundi. One severe case occurred in Gwelo District, but only one beast on the farm was infected.

Theileriosis. A marked decrease in this disease has taken place, due no doubt to a decrease in tick life—two cases Lomagundi area and one Fort Victoria.

Piroplasmosis, Anoplasmosis. Still very much in evidence—Salisbury, Bulawayo and Umtali reporting the largest number of cases.

Quarter Evil. 19 outbreaks were reported, but mortality was not high, the disease being immediately controlled by inoculation.

Mallein Testing. 120 horses were tested at Bulawayo with negative results.

Tuberculin Testing. 5 bulls, 5 cows and 21 heifers tested with negative results.

IMPORTATIONS.

Union of South Africa: 9 bulls (breeding), 45 cows and calves (breeding), 21 horses and mares, 87 geldings, 147 sheep (slaughter).

United Kingdom: 2 cows and calves (breeding).

Northern Rhodesia: 2 geldings.

EXPORTATIONS.

Northern Rhodesia: 457 oxen (slaughter), 13 cows and calves (breeding), 548 cows and calves (slaughter), 71 donkeys, 1 gelding, 10 pigs (breeding), 339 sheep (slaughter).

Portuguese East Africa: 30 oxen (slaughter), 4 cows and calves (breeding).

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage.

United Kingdom: Beef 330,275 lbs., bacon 57,974 lbs.

Union of South Africa: Beef 95,819 lbs., bacon 48,140 lbs., sausage casings, 6,330 lbs.

Bechuanaland Protectorate: Beef 6,922 lbs., bacon 311 lbs., ham 168 lbs., sausage 615 lbs., fats 155 lbs., brawn 79 lbs., offal 253 lbs.

Northern Rhodesia: Beef 159,952 lbs., pork 2,773 lbs., bacon 27,675 lbs., sausage 5,897 lbs., fats 11,193 lbs., offal 9,957 lbs., sausage casings 70 lbs.

Belgian Congo: Beef 310,885 lbs., bacon 827 lbs., offal 30,940 lbs., veal 6,592 lbs., poultry 689 lbs., mutton 8,303 lbs., sausage casings 211 lbs.

Meat Products from Liebig's (Rhodesia) Ltd., West Nicholson.

Union of South Africa: Corned beef 718,380 lbs., Oxford sausage 19,200 lbs., Vienna sausage 24,150 lbs., lunch roll 8,426 lbs., Ideal Quick Lunch 15,120 lbs., steak and kidney 24,840 lbs., curried beef 34,200 lbs., beef dripping 4,200 lbs.

Belgian Congo: Corned beef 4,464 lbs.

P. D. HUSTON,
Chief Veterinary Surgeon.

SOUTHERN RHODESIA

Locust Invasion, 1932-47.

Monthly Report No. 174: May, 1947.

Red Locust: *Nomadacris septemfasciata, Serv.*

No reports of locusts in any stage of development within the Colony were received.

J. K. CHORLEY,
Chief Entomologist.

Monthly Report No. 175: June, 1947.

Red Locust: *Nomadacris septemfasciata, Serv.*

No reports of locusts in any stage of development within the Colony were received.

J. K. CHORLEY,
Chief Entomologist.

Rhodesian Milk Records.

OFFICIAL MILK RECORDS.

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Matopo Nora	P.B. Red Poll ...	Mature	7905.30	252.75	3.20	214	Government Experimental Farm, P.B. 19K, Bulawayo.
Matopo Rose	P.B. Red Poll ...	Mature	5487.60	195.59	3.56	285	
Matopo Select... ...	P.B. Red Poll ...	Mature	5423.00	193.90	3.58	295	
Matopo Umfazi ...	P.B. Red Poll ...	2 years	5546.20	197.51	3.56	290	
Governor's Cecilia of Shanks	P.B. Guernsey ...	3 years	5059.00	257.46	5.09	300	E. J. Hards, Churchill Farm, Marandellas.
Buff Gardenia... ...	P.B. Friesland ...	2 years	6890.00	266.21	3.86	300	Sir G. M. Huggins, Craig Farm, Box 671, Salisbury.
Buff Maryke	P.B. Friesland ...	2 years	7353.00	318.27	4.33	300	
Herrenhausen Pat.	P.B. Jersey	2 years	3252.00	163.21	5.02	300	J. Keightley. Moorfield, Glendale.
Meadows Dainty 5th...	P.B. Jersey	2 years	5933.50	318.60	5.37	300	
Meadows Lotus ...	P.B. Jersey	2 years	4596.00	241.68	5.26	300	
Meadows Pioneer Daydream 2nd... ...	P.B. Jersey	2 years	3641.50	212.15	5.83	300	
Leachdale Alice ...	P.B. Friesland ...	Mature	10114.00	350.58	3.47	300	Meikles Trust & Invest. Co., Ltd., Leachdale Farm, Shangani.
Leachdale Aurelia	P.B. Friesland ...	Mature	11067.00	328.86	2.97	300	
Albert Vale Spinnekop XXVI. ...	P.B. Friesland ...	Mature	9400.50	355.82	3.79	300	T. C. Pascoe, Crowborough Estate, Box 1253, Salisbury.
Albert Vale Slangisa XII.	P.B. Friesland ...	Mature	9150.00	322.87	3.53	300	
Bluff Hill Eureka	P.B. Friesland ...	Senr. 4 years	5057.00	211.90	4.19	300	
Bluff Hill Rita II.	P.B. Friesland ...	Senr. 4 years	9794.00	349.10	3.56	300	
Bluff Hill Ella... ...	P.B. Friesland ...	Mature	11065.50	361.41	3.27	300	
Crowborough Saidie	P.B. Friesland ...	2 years	7498.50	313.44	4.18	300	
Crowborough Susan	P.B. Friesland ...	2 years	5473.50	201.71	3.69	300	
Whinburn Hoopoe	P.B. Friesland ...	Senr. 3 years	6818.00	265.67	3.90	300	Major R. R. Sharp, Whinburn, Redbank, Bulawayo

SEMI-OFFICIAL MILK RECORDS.

Sataan	G. Friesland	Mature	8167.30	279.47	3.42	300	D. A. Allan, Pendennis, Salisbury.
Roonie	G. Friesland	4 years	6458.50	227.14	3.52	300	
Janet	G. Friesland	4 years	8453.00	282.78	3.35	300	
Betty	G. Friesland	4 years	8523.80	289.83	3.40	300	
Jackson	G. Friesland	Mature	7883.00	253.99	3.22	300	G. Anderson, P.O. Box 8, Gwelo.
Mchapi	G. Friesland	Mature	5757.00	229.73	3.99	300	
Lucy	G. Friesland	Mature	5836.00	226.02	3.87	248	R. A. Ballantyne, P.O. Box 801, Sby.
Chris	G. Friesland	Mature	5607.40	227.88	4.06	300	N. G. Barrett, Gavenny, Rusapi.
Molly IV.	G. Shorthorn... ...	Mature	8465.00	364.45	4.31	300	J. H. Barry, P.O. Box 209, Umtali.
Quizzie...	G. Afrikander ...	4 years	4395.00	237.09	5.39	300	
Bella	G. Shorthorn... ...	Mature	5498.00	229.11	4.17	241	
Cecile	G. Shorthorn... ...	Mature	5806.00	242.45	4.18	253	
Dairy III.	G. Shorthorn... ...	Mature	6206.90	268.48	4.33	300	
Gwe II.	G. Shorthorn... ...	Mature	7043.70	311.83	4.43	300	
Granny	G. Short/Afri. ...	Mature	7338.50	320.50	4.37	300	
Saanie...	G. Shorthorn... ...	Mature	6727.70	295.60	4.39	300	
Joy...	G. Shorthorn... ...	Mature	6041.60	227.93	3.77	280	
Brandy	G. Friesland	Mature	7616.10	300.67	3.95	259	J. A. Baxter, Glen Norah, Salisbury.
Arrabella...	G. Friesland	3 years	6159.90	266.28	4.32	300	J. R. Bedford, Poltimore, Marandellas.
Judy I.	G. Friesland	Mature	5854.20	240.03	4.10	300	Mrs. M. Black, Burnside, Bindura.
Katie I.	G. Friesland	Mature	7841.70	270.84	3.45	300	
No. 190	G. Friesland	Mature	8286.00	292.56	3.53	300	C. Boyd Clark, Castle Zonga, Inyazura
No. 184	G. Friesland	Mature	7518.00	237.54	3.16	271	
J69	G. Friesland	Mature	7765.50	293.16	3.78	253	A. L. Bickle, Box 595, Bulawayo.
D36	G. Friesland	Mature	8919.90	299.75	3.36	300	
D53	G. Friesland	Mature	9490.60	343.00	3.61	300	
J49	G. Friesland	Mature	7337.10	245.90	3.35	300	
D61	G. Friesland	Mature	8090.20	328.73	4.06	300	
D71	G. Friesland	Mature	10355 10	345.10	3.33	300	
D124	G. Friesland	4 years	6856.80	245.98	3.59	286	
D110	G. Friesland	4 years	6875.10	257.57	3.75	300	
D121	G. Friesland	4 years	6660.10	263.56	3.96	300	
D105	G. Friesland	Mature	7247.20	296.12	4.09	300	
J58	G. Friesland	Mature	11173.40	383.57	3.52	300	
D73	G. Friesland	Mature	10052.80	375.57	3.74	300	

SEMI-OFFICIAL—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner
D69	G. Friesland	Mature	8180.40	317.13	3.88	300	A. L. Bickle, Box 595, Bulawayo.
D116	G. Friesland	3 years	6833.30	235.97	3.45	300	
D4...	G. Friesland	Mature	9952.80	344.04	3.45	300	
J70	G. Friesland	Mature	7172.80	269.22	3.75	300	
No. 72	P.B. Friesland ...	Mature	12234.50	402.26	3.29	300	
India...	G. Guernsey	3 years	6696.90	241.88	3.61	294	Miss N. Brereton, Coolmoreen, Gwelo.
Peacekop	G. Guernsey	4 years	9235.90	364.69	3.95	300	
Meg	G. Friesland	4 years	7832.10	280.26	3.58	279	
Marcia	G. Ayrshire	Mature	8757.00	280.35	3.21	300	L. E. O. Cary, Clovelly, Trelawney.
Mary	G. Friesland	3 years	6864.70	234.86	3.42	300	R. Jackson Clarke, Kingston Dairy, Gwelo.
Nana	G. Ayrshire	4 years	7700.70	294.19	3.82	285	
Sally	G. Friesland	4 years	7570.30	275.53	3.64	300	
Storm	G. Friesland	Mature	6625.90	229.47	3.46	300	
Rosemary I.	G. Friesland	Mature	7337.30	256.15	3.49	300	T. Cousins, Oaklands, Gwelo.
Marie...	G. Friesland	Mature	8337.30	398.70	4.78	261	
Sister Susie...	G. Friesland	4 years	6829.80	236.69	3.46	244	
Bobojan	G. Friesland	Mature	6654.00	241.07	3.62	280	J. Cumming, Hillside, Norton.
Anna	G. Friesland	Mature	8289.40	312.28	3.77	300	Daisyfield Orphanage, P.O. Daisyfield.
Stompie	G. Friesland	Mature	8151.60	299.02	3.67	300	
Lea	G. Friesland	Mature	5802.00	264.01	4.55	300	A. C. De Olano, Blue Waters, Bromley.
Ophelia	G. Friesland	Mature	10444.00	362.40	3.58	300	
No. 192	G. Friesland	3 years	7350.30	259.46	3.53	300	J. B. Dold, Stoneridge, Salisbury.
R165	G. Friesland	4 years	6424.60	225.00	3.50	300	
No. 89	G. Friesland	Mature	6798.00	256.16	3.77	300	Mrs. M. Everard, Castle Zonga, Inyazura.
No. 206...	G. Friesland	Mature	8066.00	275.55	3.42	298	
No. 247	G. Friesland	Mature	7521.50	244.15	3.25	271	H. C. Fischer, Olivia Farm, Headlands.
No. 6	G. Friesland	Mature	6958.00	271.55	3.90	300	

No. 31	G. Friesland	Mature	6847.00	311.72	3.52	289	R. le S. Fischer, Wakefield, Headlands.
No. 128...	G. Friesland	Mature	9298.00	325.77	3.50	300	
No. 83	G. Friesland	3 years	10702.00	391.07	3.65	300	
No. 38...	G. Friesland	4 years	10615.00	377.92	3.56	300	
No. 75...	G. Friesland	3 years	11470.00	379.27	3.31	300	
No. 129	G. Friesland	2 years	6550.00	248.16	3.79	300	
No. 52...	G. Friesland	4 years	7213.00	248.95	3.45	271	
No. 4	G. Friesland	Mature	8740.00	271.46	3.11	288	
No. 89...	G. Friesland	3 years	7380.00	269.62	3.65	284	
No. 355...	G. Friesland	Mature	7394.50	242.09	3.27	293	W. F. Fischer, Coldstream Dairy, Headlands.
No. 490...	G. Friesland	4 years	7764.50	249.51	3.21	300	
No. 392...	G. Friesland	Mature	6643.50	241.09	3.63	300	
No. 453...	G. Friesland	Mature	8600.00	282.85	3.29	300	
No. 274...	G. Friesland	Mature	7535.00	234.85	3.12	300	
No. 423...	G. Friesland	Mature	6676.50	236.78	3.55	300	
No. 18A...	G. Friesland	Mature	7721.50	242.28	3.14	275	
Gilston Cleo	P.B. Red Poll ...	Mature	6480.00	239.84	3.70	300	G. N. Fleming, Gilston, P.O. Box 688, Salisbury.
Very Nice II.	G. Friesland	Mature	9320.60	342.66	3.68	300	G. J. Franklin & Son, Box 105, Umtali.
Saucy	G. Friesland	Mature	6547.50	258.78	3.95	300	
Mhaka	G. Friesland	Mature	5425.50	230.87	4.26	300	
Mgurwe II.	G. Shorthorn... ...	Mature	7713.10	321.09	4.16	300	
Peggy...	G. Friesland	Mature	7887.40	289.05	3.66	300	
Penhalonga II. ...	G. Friesland	Mature	8329.80	324.62	3.90	300	
Mina	G. Friesland	Mature	7992.00	335.17	4.20	300	
Dora	G. Friesland	Mature	9568.70	407.88	4.26	300	
Adam	G. Friesland	Mature	10086.20	406.50	4.03	300	
Gondall	G. Friesland	4 years	7879.20	242.86	3.08	300	P. Freeland, Lingfield, Gwelo.
Jermima...	G. Friesland	Mature	6691.20	225.66	3.37	267	
Poppy	G. Friesland	Mature	7387.20	243.26	3.29	300	
Sunflower	G. Friesland	Mature	8344.00	269.69	3.23	300	
Toto	G. Friesland	4 years	6105.40	238.90	3.91	300	
A31	G. Friesland	Mature	6924.80	231.60	3.34	300	
Bottle No. 35	G. Friesland	Mature	7040.40	232.90	3.31	300	
A41	G. Friesland	Mature	7627.30	269.69	3.53	300	
No. 93	G. Friesland	Mature	6792.80	226.88	3.34	300	
Best	G. Friesland	Mature	7233.00	252.88	3.50	300	Hon. H. V. Gibbs, Bonisa, P.B. 52L, Bulawayo.
Fatty	G. Friesland	Mature	8839.00	290.28	3.28	300	
Fay	G. Friesland	Mature	8054.00	293.69	3.65	300	
Gay	G. Friesland	Mature	6436.00	256.66	3.99	300	

SEMI-OFFICIAL.—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Greta	G. Friesland	Mature	8942.00	311.01	3.48	300	Hon. H. V. Gibbs, Bonisa, P.B. 52L, Bulawayo.
Hope	G. Friesland	Mature	8828.00	286.43	3.25	300	
Lynn	G. Friesland	Mature	8269.00	291.91	3.53	300	
Mary	G. Friesland	3 years	8707.00	349.43	4.01	300	
Sunshine	G. Friesland	Mature	6721.00	228.59	3.40	300	
Taffy	G. Friesland	4 years	7810.00	360.08	4.71	300	
Una	G. Friesland	Mature	10875.00	390.08	3.59	300	
Gouwsplant Rika IV....	P.B. Friesland ...	3 years	7926.50	264.95	3.34	300	Grassland Experimental Station, Marandellas.
No. 30	G. Friesland	Mature	11848.00	443.57	3.83	300	
No. 61	G. Friesland	2 years	7971.60	278.82	3.49	300	
No. 52	G. Friesland	Mature	6834.10	255.95	3.75	300	R. H. Greaves, Fountain, Nyamandhlovu.
Garbo	G. Friesland	Mature	5736.70	228.91	3.99	298	E. E. C. Green, Box 879. Bulawayo.
Jet	G. Friesland	Mature	7440.80	268.58	3.61	246	
E207	G. Friesland	Mature	7107.40	254.40	3.55	277	
Pam	G. Guernsey	Mature	5317.40	249.11	4.68	300	D. A. Harley, Harleyton, Beatrice.
Tilly	G. Guernsey	Mature	6864.80	298.68	4.35	300	
Anne	G. Guernsey	Mature	7221.80	255.72	3.54	300	
June	G. Guernsey	Mature	6468.00	265.61	4.11	280	
Petal	G. Guernsey	Mature	6771.50	277.08	4.09	300	
Dolly	G. Guernsey	Mature	6108.00	265.21	4.34	286	
Bridget	G. Guernsey	Mature	8341.10	345.32	4.14	300	
Jill	G. Guernsey	Mature	6378 90	269.32	4.22	300	
Gipsey II.	G. Guernsey	4 years	6290.60	265.21	4.22	300	
Heather	G. Guern./Fries.	Mature	8180.10	301.56	3.69	300	
Molly II.	G. Guernsey	Mature	5311.00	231.52	4.36	300	
Mona	G. Guernsey	Mature	6855.10	281.82	4.11	300	
Ida	G. Guernsey	Mature	6062.20	254.68	4.21	300	
Ruth	G. Friesland	Mature	7782.30	247.11	3.18	300	
Coral	G. Guernsey	Mature	5630.30	252.54	4.49	300	
Rita II.	G. Guernsey	Mature	8129.50	275.82	3.39	300	
Ruby	G. Guernsey	Mature	6447.90	238.29	3.70	300	
Ivy	G. Guernsey	Mature	7445.50	252.74	3.39	300	

Hazel	G. Guernsey	Mature	7134.70	281.31	3.94	300	D. A. Harley, Harleyton, Beatrice
Dorothy	G. Guernsey	Mature	5926.30	241.05	4.07	300	
Dallas	G. Guern./Fries.	Mature	5992.10	247.50	4.13	300	
Buttercup	G. Ayrshire	Mature	5706.00	233.85	4.10	300	Mrs. C. Harrison, Box 58, Shamva.
Betty II.	G. Friesland	Mature	5769.00	244.81	4.24	300	N. M. Hathaway, Chakadenga, Mangwendi.
Daff	G. Friesland	Mature	5905.90	234.70	3.97	300	
Malvina	G. Friesland	Mature	7272.70	239.48	3.29	300	
Raye	G. Friesland	Mature	5730.10	229.93	4.01	300	
Janet	G. Guernsey	4 years	7708.50	310.08	4.02	300	Mrs. L. M. H. Howard, Nengwa, Beatrice.
Susan	G. Guernsey	3 years	5597.30	242.38	4.33	300	
Bridget	G. Guernsey	3 years	7033.00	305.34	4.34	300	
Pegotty	G. Guernsey	3 years	6154.60	306.85	4.99	300	
Gift	G. Friesland	Mature	7316.90	248.09	3.39	274	D. J. Huddy, Box 718, Salisbury.
Ardbennie II.	G. Friesland	Mature	7267.70	279.42	3.84	285	
Daisy	G. Guernsey	4 years	7165.30	311.73	4.35	291	L. Huddy, Box 924, Salisbury.
Limbe	G. Friesland	Mature	8361.50	267.12	3.19	277	
Beatrice	G. Friesland	Mature	7722.80	296.00	3.83	300	
Macheke	G. L.R./Shorthorn	Mature	7168.80	270.79	3.78	278	
No. 14	G. Friesland	Mature	12595.00	434.58	3.45	300	D. S. Kabot, Box 261, Bulawayo.
No. 33	G. Friesland	Mature	5390.00	258.42	4.79	300	
No. 39	G. Friesland	Mature	8817.00	327.73	3.72	300	
No. 43	G. Friesland	Mature	12241.00	416.27	3.40	300	
No. 53	G. Friesland	Mature	9427.00	423.37	4.49	300	
No. 74	G. Friesland	Mature	9587.00	369.24	3.85	300	
No. K15	G. Friesland	Mature	7725.60	311.55	4.03	292	B. H. Kew, Box 972, Bulawayo.
No. 9	G. Fries./Hereford	Mature	7141.00	322.74	4.52	300	
No. 4	G. Friesland	Mature	9115.70	291.64	3.20	300	
D8	G. Friesland	Mature	9781.70	336.21	3.44	300	
K21	G. Friesland	Mature	8053.50	331.11	4.11	300	
Ann	G. Friesland	Mature	8593.70	279.93	3.26	300	D. King, Rockwood Farm, Concession.
Axel	G. Friesland	Mature	6196.60	338.41	5.46	300	
Naomi	G. Friesland	Mature	9581.80	307.28	3.21	300	
Sally II.	G. Friesland	Mature	9003.10	304.16	3.38	300	
Lazy	G. Friesland	Mature	5840.30	249.56	4.27	300	Mrs. M. Krahner, Haydock Park, Banket.

SEMI-OFFICIAL—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Jeempie II.	G. Friesland	Mature	7295.20	267.73	3.67	300	P. Linton, Carnock Farm, Salisbury.
Beans II....	G. Friesland	4 years	7686.80	273.65	3.56	300	
No. 6	G. Friesland	Mature	7433.80	258.87	3.48	300	D .W. Marshall, Box 164, Umtali.
Mshope...	G. Ayrshire	Mature	8077.00	314.03	3.89	300	Liet.-Col. C. I. F. Maynard, P.B. 112C. Salisbury.
No. 457	G. Guernsey	3 years	6491.50	262.50	4.04	300	J. R. McLaren, Safago, Gwelo.
No. 380	G. Guern./Fries.	Mature	7400.20	282.04	3.81	300	
No. 403	G. Guernsey	4 years	5901.80	257.17	4.36	298	
No. 443	G. Guernsey	3 years	6298.70	276.10	4.38	276	
No. 423	G. Guernsey	4 years	7290.30	298.34	4.09	300	
No. 387	G. Guern./Fries.	Mature	7959.00	314.98	3.96	279	
No. 456	G. Guern./Fries.	3 years	5822.90	268.16	4.61	297	
No. 350	G. Guern./Fries.	Mature	6104.60	230.48	3.78	237	
Bulawayo No. 2 ...	G. Friesland	3 years	6153.70	249.03	4.05	300	J. H. McLean, Box 161, Gwelo.
Fork	G. Friesland	Mature	7904.40	321.06	4.06	300	
Hopman	G. Friesland	3 years	6733.00	281.72	4.18	300	
Eileen	G. Red Poll	Mature	6397.10	247.60	3.87	300	
June	G. South Devon	Mature	6596.10	233.94	3.55	300	
Regop...	G. Ayrshire	4 years	6302.70	248.59	3.94	300	
Tomby I.	G. Friesland	Mature	6909.60	243.68	3.53	296	
Hans	G. Friesland	4 years	5871.90	240.51	4.09	288	
Kirstein	G. Friesland	Mature	6648.00	227.28	3.42	281	
No. 1	G. Friesland	4 years	6636.30	247.08	3.72	300	L. McLean, Box 161, Gwelo.
No. 7	G. Friesland	Mature	5181.40	234.88	4.53	250	
No. 14/9	P.B. Friesland ...	Mature	11713.00	363.75	3.11	300	Meikles Trust & Investment Co., Ltd., Leachdale Farm, Shangani.
P.6/2	P.B. Friesland ...	4 years	8016.00	306.49	3.82	300	
G.16/1	G. Friesland	4 years	8346.00	283.06	3.39	273	
G.9/2	G. Friesland	3 years	8370.00	299.47	3.58	300	
G.181	G. Friesland	Mature	10668.00	363.83	3.41	300	
G.212	G. Friesland	Mature	8265.00	267.66	3.24	300	
Paula	G. Red Poll	Mature	5643.20	254.13	4.50	300	Capt B. L. Miles, Muneni, Banket.

Wendy	G. Red Poll	Mature	6963.00	273.98	3.93	300	C. F. Mitchell, Box 1027, Bulawayo.
Snowflake II.	G. Friesland	Mature	5830.70	243.77	4.18	300	S. Moore, Box 999, Salisbury.
Tommy II.	G. Friesland	Mature	6206.10	230.68	3.72	283	
Black	G. Friesland	Mature	7259.10	299.63	4.13	284	
Joan	G. Friesland	Mature	6038.20	251.85	4.17	300	Commander E. L. Morant, Box 741, Salisbury.
Phyllida	G. Ayrshire	Mature	6360.80	251.84	3.96	300	
Doris	G. Friesland	Mature	6644.70	254.94	3.84	300	
Royce	G. Ayrshire	Mature	6642.00	289.87	4.36	300	
Princess Marina ...	G. Friesland	3 years	5292.10	234.00	4.42	300	G. R. Morris, Box 1040, Salisbury.
Gizima...	G. Friesland	Mature	6667.50	269.74	4.05	300	
Maliseni	G. Friesland	Mature	7411.90	278.71	3.76	300	
Spoon	G. Friesland	Mature	8961.00	305.78	3.41	300	F. B. Morrisby, Box 36, Gwelo.
No. 78	G. Friesland	Mature	7521.00	239.11	3.18	300	
No. 142	G. Friesland	Mature	9180.00	297.47	3.24	300	
No. 141	G. Friesland	Mature	6698.00	228.21	3.41	295	
Headlands	G. Friesland	Mature	5897.50	257.37	4.36	300	J. T. Mungle, Myreside, Odzi.
Chikopa	G. Friesland	Mature	8112.00	271.29	3.34	300	
Gooseberry	G. Red Poll	Mature	7262.00	256.32	3.54	300	K. Norvall, Box 637, Bulawayo.
Gwelo	G. Red Poll	Mature	8577.00	324.22	3.76	300	
Doros II.	G. Friesland	4 years	6189.00	238.71	3.86	300	
Numnet	G. Friesland	Mature	8495.00	296.62	3.49	300	
Side Umgusa	G. Friesland	Mature	7625.00	253.03	3.32	276	
Jenny	G. Friesland	4 years	7452.80	281.09	3.77	300	E. Palmer, Ferndale, Penhalonga.
Daisy	G. Friesland	Mature	7393.50	264.15	3.57	283	
Meg	G. Friesland	4 years	7983.20	325.05	4.07	268	
Peggy II....	G. Shorthorn ...	4 years	5846.70	297.38	5.09	281	
Shasha	G. Shorthorn ...	Mature	8282.20	336.71	4.07	249	
No. 16	G. Friesland	Mature	6378.40	303.62	4.76	300	T. C. Pascoe, Box 1253, Salisbury.
DI (197)	G. Friesland	Mature	9740.30	359.85	3.69	292	
No. 76	G. Aber. Angus...	Mature	6398.40	264.64	4.14	300	
No. 55	G. Friesland	Mature	7133.70	243.35	3.41	300	
No. 94	G. Friesland	Mature	10538.30	373.09	3.54	300	
No. 176...	G. Short./Fries.	Mature	5076.60	244.72	4.82	300	
No. 40	G. Friesland	4 years	7282.00	234.63	3.22	300	J. Picken, P.O. Iron Mine Hill.
No. 32	G. Friesland	Mature	6108.00	257.78	4.22	300	
No. 2	G. Friesland	Mature	6720.00	267.28	3.98	300	

SEMI-OFFICIAL—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Nursie...	G. Friesland	Mature	7358.00	243.57	3.31	289	Mrs. Worthington Reed, Clifton Down, Gwelo.
Rooi-Meis...	G. Guernsey	Mature	4622.60	239.40	5.18	260	Salvation Army, Box 14, Salisbury.
Nellia	G. Friesland	Mature	8811.70	296.42	3.36	300	W. F. H. Scutt, Maple Leaf, Norton.
Coffee	G. Friesland	Mature	7448.20	261.18	3.51	300	
Wankis	G. Friesland	4 years	8139.70	273.39	3.36	300	
January	G. Friesland	Mature	9134.10	287.23	3.14	300	
Dikison	G. Friesland	Mature	6685.70	283.90	4.23	300	
Ndeleya	G. Friesland	Mature	6739.90	243.81	3.62	285	
Michael	G. Friesland	Mature	6412.10	261.81	4.09	288	
Cathleen	G. Friesland	Mature	6060.00	266.46	4.40	300	Mrs. V. Stead, Ascot Vale, Gwelo.
G.15	G. Ayrshire	4 years	6481.00	262.27	4 05	300	J. R. Stewart & Sons, Battle Farm, Shangani.
G.18	G. Ayrshire	3 years	5847.00	228.46	3.91	297	
P.18	P.B. Ayrshire ...	Mature	6135.00	229.20	3.73	233	
P.20	P.B. Ayrshire ...	4 years	6049.00	244.94	4.05	300	
P.22	G. Ayrshire	3 years	6205.00	257.61	4.15	299	
No. 19 Petal...	G. Friesland	Mature	6568.00	233.53	3.56	300	Susman & Newfield, Box 323, Salisbury.
Pyjamas	G. Friesland	Mature	7882.50	262.62	3 33	300	
Pennance...	G. Friesland	Mature	5841.00	256.71	4.39	300	
Esther	G. Friesland	Mature	5778.50	230.23	3.98	300	
Tap	G. Friesland	3 years	6475.50	253.73	3.92	300	
Shine	G. Friesland	3 years	6161.00	235.63	3.82	300	
Pride	G. Friesland	3 years	6221.00	243.77	3.92	300	
Sybil	G. Friesland	Mature	6741.40	254.20	3.77	300	H. Stobart, P.O. Arcturus.

Bandit II.	G. Friesland	Mature	7142.00	233.04	3.26	300	E. Tapson Trust, Ltd., Lesapi Falls, Rusapi.
Button	G. Friesland	3 years	9116.00	320.99	3.52	286	
December	G. Friesland	4 years	7422.00	294.59	3.97	300	
England	G. Ayrshire	Mature	6560.00	227.94	3.47	292	
Girida II.	G. Ayrshire	Mature	6643.00	237.98	3.58	300	
Inyazura...	G. Ayrshire	Mature	6387.00	227.99	3.57	300	
June	G. Friesland	Mature	7818.00	279.78	3.58	300	
Ngamera I....	G. Ayrshire	Mature	7907.00	297.38	3.76	300	
Night	G. Friesland	Mature	6760.00	263.44	3.90	255	
Mushandida	G. Ayrshire	4 years	7078.00	292.28	4.13	300	
Liza...	G. Friesland	Mature	5190.20	225.23	4.34	252	A. W. Tennent, Kelvin, Headlands.
Mareta	G. Friesland	Mature	5906.70	231.88	3.93	300	
England	G. Friesland	Mature	7914.30	315.93	3.99	300	J. G. Thurlow, Atherstone, Bindura.
Bella	G. Friesland	Mature	6925.00	228.84	3.30	300	W. E. Tongue, Box 199, Bulawayo.
Daisy II.	G. Friesland	Mature	7303.00	296.85	4.06	300	
Dimity	G. Friesland	Mature	13757.00	431.85	3.14	300	
Kate	G. Friesland	Mature	14366.00	526.05	3.66	300	
Kiwi II.	G. Friesland	Mature	10165.00	333.25	3.28	300	
Klim	G. Friesland	Mature	10766.00	383.50	3.56	300	
Redleaf Ella B.6 ...	P.B. Red Poll ...	Mature	5811.50	247.66	4.26	300	A. M. Tredgold, P.B. 61L, Bulawayo.
T.B. 9	G. Red Poll	Mature	6161.00	236.35	3.84	300	
No. L.18	G. Red Poll	Mature	6141.00	249.75	4.07	300	
No. 127	G. Red Poll	Mature	5658.50	254.12	4.49	286	
No. 131	G. Red Poll	Mature	7833.00	282.72	3 63	300	
No. 138	G. Red Poll	Mature	5494.00	229.15	4.17	300	
No. 179	G. Red Poll	Mature	5831.00	229.85	3.94	300	
No. 181	G. Red Poll	Mature	7966.50	352.51	4.43	300	
No. 192	G. Red Poll	Mature	6644.00	280.25	4.22	300	
No. 211	G. Red Poll	Mature	7289.50	299.87	4.11	300	
Lena	G. Friesland	Mature	6925.60	280.06	4.04	265	Mrs. M. Turnbull, Box 479, Bulawayo.
Moth	G. Friesland	2 years	7291.50	273.85	3.76	300	

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Editorial

Notes and Comments

REVIEW OF "JOINT PUBLICATION No. 10. THE USE AND MISUSE OF SHRUBS AND TREES AS FODDER."

(Published by Imperial Bureau(x) of Animal Nutrition, Aberdeen, Pastures and Field Crops, Aberystwyth, and Forestry, Oxford. Price 9s. from Imperial Agricultural Bureaux, Central Sales Branch, Penglais, Aberystwyth, Great Britain.)

This publication deals with the latest findings and experience on this all-important subject in Australia, New Zealand, Africa, India, Ceylon, Mediterranean Lands, Near and Middle East, U.S.S.R., United States of America and Canada. It includes a most valuable section on the Chemical Composition and Digestibility of Fodder, Shrubs and Trees as well as a useful key to Common Plant Names and a Geographical Index.

Edible trees and shrubs form the most important source of forage supply in Australia due to her climatic conditions. In the coastal regions of Queensland and North Territory sown forage crops and to a limited extent pasture grasses make up the sole source of forage. A few indigenous trees are used as a reserve for fodder, e.g., *Avicennia marina* var. *resinifera* (the white mangrove), *Sideroxylon pohlmannianum* var. *vestitum* (velvet leaf), *Acacia implexa* and *A. maidenii* (sally wattles), and *Ficus* sp. In sub-coastal region (rainfall 25 inches per annum) *Heteropogon contortus* (bunch spear grass) and *Bothriochloa decipiens* (pitted blue grass) provide native forage for large numbers of stock. Details of plant formation and natural pastures are given. There are few virulently toxic trees or shrubs in the northern area.

In Victoria grazing of scrub is practically limited to the Mallee District where the problems of fodder conservation, soil erosion and reclamation of semi arid lands are very important.

Forage plants are not of particular importance in Western Australia.

In the section dealing with New Zealand it is interesting to note that the Department of Agriculture and Department of Scientific and Industrial Research have commenced research to cover botanical, chemical and physiological aspects of stock poisoning by plants.

In South Africa the stock live and feed in the open and the natural pastures or veld forms the bulk food. Mineral licks are given in those areas which are deficient in phosphorus and salt. The veld varies in feeding value according to season and rainfall. Two lists of the most commonly eaten shrub species are detailed in this section. The first list includes the so called Karroo bushes.

During the last 15 years research has been carried out on the Veld Reserve, Fauresmith, in connection with the chemical composition, palatability and carrying capacity of shrubs. Their management has been studied on various farms and the influence of bad and good treatment ascertained.

Quite a number of exotic fodder trees have been cultivated in South Africa, the main ones being *Prosopis sp.* and the Honey Locust tree (*Gleditschia triacanthos*).

In British Somaliland trees and shrubs must from necessity form an important source of fodder owing to poor grass and the large numbers of camels which browse there. In addition the Somali herdsmen cut and bend branches of Acacias so that sheep and goats can reach the leaves and this causes destruction of the trees. If a system of deferred grazing could be introduced more fodder would result.

Fodder trees and shrubs are also of considerable value in French Equatorial and French West Africa. Some parts are rich in halophytes which offer permanent forage for sheep, goats and camels.

Uncontrolled cultivation has led to devastation in the low rainfall areas of Kenya. Before any degree of conservation can be reached a policy of controlled grazing, reduction in stocking and improvements in tribal standards will have to be introduced.

In Tanganyika the presence of tsetse in the woodland area prevents the keeping of stock. Cattle live on green grass till May and later on dry grass, leaves and pods. From the middle of October dead leaves form a large part of stockfeed. The most important shrub is *Disperma trachyphyllum*, which is resistant to fire and drought.

In Uganda there is little need for fodder trees and shrubs owing to the adequate rainfall which ensures well established pastures.

In the Anglo-Egyptian Sudan trees and shrubs are very necessary for fodders. Mesquite is being introduced. *Acacia arabica* and *Acacia albida* are very valuable as their pods have good feeding value. *Acacia albida* pods have an advantage over other acacia pods as they do not deteriorate on drying. Sheep and goats eat the fruits of *Zizyphus spina christi* while the foliage is eaten by the camels. This feed keeps stock in good condition.

Trees are often called upon to supplement grass in the dry season and when crops are ripening, by the nomadic cattle owners of Nigeria. So far there has been no plan to manage forests, especially for fodder.

In the Gold Coast there are few edible shrubs. In the dry season *Afzelia africana*, *Acacia albida* and *Ficus gnaphalocarpa* are lopped for sheep and goats and even at times for cattle. Fodder trees will continue to form a very necessary part in livestock feeding until such time as better methods of grassland management and fodder conservation are developed.

Haymaking and ensilage are seldom practised in India and Ceylon, therefore tree fodder is very essential. In reserved forests grazing and lopping are either forbidden or carefully regulated and only a limited number of cattle have access to forests. *Prosopis spp.* is very valuable as two crops a year are produced in the plains. The pods form excellent fodder, the wood of the mature tree can be used as fuel while the root system is such that it lends itself as a valuable factor in the prevention of soil erosion. *Acacia arabica* is also useful.

In Bengal practically no lopping of trees for fodder is allowed.

In Bombay there is sufficient grass supplemented by field crops for cattle fodder requirements. Lucerne is grown in irrigated areas. *Hardwickia binata* (anjan) leaves form a valuable fodder. In the forest districts cattle do not often resort to tree leaves for fodder.

The Forestry Department of India are endeavouring to preserve and extend these forests which yield important fodder trees, such as *Hardwickia binata*, *Acacia arabica*, *Erythrina indica*, *Ficus sp.*, *Melia azadirachta*, *Zizyphus jujuba*, etc. It is felt that the need for leaf fodder in certain parts of India would disappear if the following measures were taken:—

(1) Sound water and soil conservation policy in all dry districts to increase quantity of roughages.

(2) More extensive introduction of improved pasture management.

(3) Storage of surplus monsoon fodder by ensilage and haymaking in suitable areas.

In Ceylon an important fodder species is *Mikania scandens*, an exotic succulent climber whose leaves and tender vines are highly relished by cattle.

In the lands of Mediterranean littoral and islands one can see deforestation followed by denudation of the sub-climax shrub cover by burning, cutting for fuel and grazing by domestic animals.

In the section devoted to U.S.S.R. valuable tables are given showing the chemical composition of different families of fodder plant and also the nutritive value of the principal families of the flora of the U.S.S.R. Plans for the founding of highly productive centres of animal husbandry in the semi-desert are well in hand as artificial fodder resources are very necessary.

In the United States of America grasses yield the greater part of forage on nearly all forest and other ranges in the West. Most ponderosa pine forests of the Western United States and long leaf pine forests of the Coastal Plains of the south and south-east are sufficiently open to bring forth a good cover of grass, herbs and shrubs suitable for grazing provided it is managed so that timber production is not endangered.

In America natural regeneration of coniferous trees is not, in general, palatable to livestock.

Aspen and yellow poplar are palatable to cattle, sheep, goats and big game animals.

Invasion of grasslands by Mesquite (*Prosopis sp.*), Cedar (*Juniperus pinchotii*, *J. mexicana* and *J. virginiana*) and Cactus (*Opuntia sp.*) is causing concern. This invasion of the Mesquite is considerably lessening its value as a forage and fuel contributor.

Trees and shrubs form an important source of forage in certain areas. The bulk of the grazing, however, is obtained from grasses and other herbaceous plants. Although there are poisonous plants in Canada they seem to be chiefly herbaceous and few trees and shrubs have been found to be poisonous to livestock.

The Salicaceae provide the highest forage value while the Chenopodiaceae (including *Eurotia* sp. and *Atriplex* sp.) are also good.

The section under Canada includes a table showing the chemical composition of the principal forage trees of Western Canada.

Imperial Agricultural Bureaux.

The following Preface to the Imperial Agricultural Bureaux Annual Report for 1945-46 is given in full for general information as follows:—

The Imperial Agricultural Research Conference, 1927, stressed (a) the need for scientists to be in touch with the progress of research throughout the world in their several branches; and (b) the difficulty therein owing to the great output of scientific literature and the diversity of languages in which it is published.

2. It recommended the Governments of the British Commonwealth to establish on a joint co-operative basis eight bureaux to collect, collate and disseminate information on research in eight selected branches of agricultural science and generally to assist research workers in the Empire with information relevant to their subjects. Each bureau was to be located at a research Institute specialising in its own branch of science so that the bureau officers should be in daily contact with men engaged on research in its own subject. These bureaux were to be financed from a common fund contributed by Empire Governments in agreed proportions and controlled by a Council composed of representatives of those governments on an equal footing.

3. Governments accepted these proposals. In November, 1928, a new type of inter-Imperial co-operative agency acceptable to all governments was worked out in detail. On 1st April, 1929, the Executive Council of the Imperial Agricultural Bureaux came into being. The eight bureaux started work in that year.

4. Following the Ottawa Conference of 1932 the work of several inter-Imperial agencies was examined and reported upon by the Imperial Committee on Economic Consultation and Co-operation (1933). This Committee approved of the bureaux organisation and of its work, and extended the duties of the Council, inter alia proposing that with effect from 1st October, 1933, it should also be responsible for the supervision and administration and finance of the Imperial Institute of Entomology and of the Imperial Mycological Institute.

5. It also enunciated certain general principles to be observed in regard to the organisation of agencies for inter-Imperial co-operation and consultation, e.g., Constitutional equality of participating governments in the appointment of the Authority administering the work; the provision of adequate finance for a definite period of years; careful and periodical examination of the work and organisation of the Agency at Empire conferences suitable for the purpose, as without that assurance governments could hardly be expected to provide the adequate continuing finance; responsibility of the administering authority to all participating governments. All Governments accepted this report.

6. The British Commonwealth Scientific Conference (1936) conducted the first of these "periodical examinations." It ap-

proved both the work and organisation. It recommended the finance necessary until 1941/42 (extended later to cover the war period), its distribution between governments, also the formation of two more bureaux, and certain modifications in practice designed to improve general efficiency. Governments accepted these proposals.

7. The organisations under the administration of the Executive Council are:—

The Imperial Institute of Entomology, with its branch, the Imperial Parasite Service.

The Imperial Mycological Institute and the Imperial Bureaux of

Soil Science.
Animal Health.
Animal Nutrition.
Animal Breeding and Genetics.
Plant Breeding and Genetics.
Pastures and Forage Crops.
Horticulture and Plantation Crops.
Agricultural Parasitology (Helminthology).
Dairy Science.
Forestry.

8. A "liaison" officer appointed by the appropriate department in each participating country keeps in touch with administrative matters, and in each country for each bureau a scientific officer is nominated as Official Correspondent to be "the general friend" on scientific matters of that bureau in that country. The Heads of the several Institutes at which bureaux are located act as Consultant Directors of the bureaux, thus giving the Council and bureaux the benefit of their wide experience and scientific knowledge. All other officers are whole-time servants of the Executive Council.

As a measure for paper economy, the usual list of publications has been omitted from this report. Copies of the 1947 list are, however, available for those desirous of consulting them, and will be supplied on application to:—

The Imperial Agricultural Bureaux, Central Sales Branch, Agricultural Research Building, Penglais, Aberystwyth, Wales, or to the Secretary, Imperial Agricultural Bureaux, 2, Queen Anne's Gate Buildings, Dartmouth Street, London, S.W.1.

Machines for the Smallholder.

By L. A. G. BARRETT, Literary Officer, Massey Agricultural College, New Zealand.

Something of the great post-war advances made in the cultivation and care of market gardens and areas in small fruits was seen at two demonstrations of small tractors and implements, held at Massey Agricultural College, New Zealand. The demonstrations, for which machines were drawn from any parts of the North Island, gave about 300 people an opportunity to survey in a new light the whole field of their work for the future, and to judge how best and most economically that work might be carried out.

The relative values of the new machines which have come on to the market since the war will naturally be a matter for individual opinion. There was, however little difference of opinion on the general impressions left by the demonstrations; such as the great diversity of labour-saving machinery now available to the smallholder, the adaptability of the small tractors to work a wide variety of implements from ploughs to inter-row cultivating and spraying equipment, and the fact that British made machines figured largely among the 15 or 16 power units seen in action.

These units ranged from 12 horse-power tractors equipped with a driver's seat to 1½ horse-power units handle-steered by the operator as he walked beside or behind. Useful devices in these smaller units included the ability to cultivate right up to the roots of leafy plants such as cabbages without injuring the growth above ground, and alternative setting of the handles so that the operator need not walk over any fine seed-bed produced in the wake of the machine. These units can be changed quickly from cultivation work among vegetables and flowers, to the spraying of small fruits or for use as motive power for lawn mowers. Many of the attachments for inter-row work were capable of dealing with two or three rows at a time.

Other refinements incorporated in the smaller power units were a variety of forward speeds and at least one reverse gear. The latter proved very adaptable in action in allowing work right up to plants, and in making for short and accurate turnings at headlands. A safeguard against accident to the operator while the machine was travelling in reverse was a lever projecting so that its contact with the operator would automatically cut off the engine.

The smaller power units, largely for use on well-established holdings, had their counterpart in larger types for the breaking-in of land and for use on extensive vegetable and small-fruits areas such as supply the canneries and dehydrating plants at Hawke's Bay. One of the larger tractors, about 3½ feet in width, was of the crawler type, and of its size new to New Zealand. This 6 horse-power machine consumes anything from two to four pints of petrol per hour, according to the load. Its 10½ hundredweight is so spread over its rubber-jointed tracks that the ground pressure is only 4½ lb. to the square inch.

The purchase prices of several of the machines were announced by those representatives of firms who acted as demonstrators. These figures ranged from about £75 to nearly £600. Some of the machines are scarcely on the market yet, as those in action were on occasions the first of their type to be imported to the Dominion.

Thanks to Massey College for arranging the demonstrations, and thereby enabling growers to obtain a comprehensive view of what was offering, were conveyed by representatives of the machinery firms. The principal of the College (Professor G. S. Peren) stated that the College was only too pleased to be used as a gathering ground for such purposes, and especially in the present instance, in view of the part which greater mechanisation could play in reducing the heavy per-acre bill for labour in horticultural undertakings.

(It is interesting to note that the Royal Horticultural Society recently had one of these tractors for demonstration purposes at Wisley and were very satisfied with its performance. Also it is understood that one of these tractors has been ordered by a farmer in Rhodesia at an approximate cost of £280, which includes a plough and cultivator.—Ed.)

Some Hints for Anglers on Fish Pests.

By R. H. R. STEVENSON, F.R.E.S.

[Continued from July/August Issue.]

Amongst the *Crustacea*, the fresh water CRAB is to be classed amongst the fish predators. They are common in most waters, and apart from their burrows in the banks of dams and furrows being destructive, and their nuisance value as bait thieves, which causes the loss of much valuable fishing tackle, they actually catch and eat small fish, both aluvins and fry, up to fingerlings. Their destruction, too, of ova must be enormous, and they actually get into trout hatching boxes unless properly protected, besides pulling ova through the zinc apertures of the boxes, which have to have a protective double screen to keep them away. As far as I know, no efficacious method has been evolved to eradicate them. I should suggest a trap after the style of a lobster pot or minnow trap, but with apertures big enough for fish to escape. Half-inch wire mesh should do, using bad meat for baits, but I have not tried this. Small crabs seem to be the favourite food of trout and other predacious fish, and the otters must make them their main diet. It may be that some people reading this know of some means of destroying them, and will make their methods available by a letter to the Agricultural Department.

The Class "Reptilia" are scaly, cold-blooded vertebrates, which breathe with lungs, and are, therefore, unable to stay indefinitely under water. We have to consider, first, the Crocodile, which belongs to the order *Crocodilia* and is not one of the lizards. *Crocodilus nilolicus* (Lin) lives in all tropical waters and mostly on fish. For this reason alone, it should be considered an enemy, but, as we well know, it is also dangerous to human beings and should be shot on all occasions possible. It has been recorded up to 21 feet 6 inches in East Africa, but anything over 13 feet is a large one in this part of the sub-continent. It breeds from September to the beginning of the rainy season, which is the hottest time of the year, and lays hard-shelled eggs in dry sand in certain selected situations.

They scrape out a hole about 12 ins. to 18 ins. deep and carefully cover the eggs with sand. They remain near the spot, but whether from an instinct to preserve their eggs or from exhaustion, I am unable to state. The large MONITOR LIZARD is their chief and almost only enemy, as it scoops out the eggs and devours them.

A point of fact that is worth noting is that the eggs are extremely sensitive to damp and are only laid during a dry spell about September to December. They are smooth-shelled, long ovates, and when blown seem to crackle and eventually disintegrate unless kept in an even temperature. The slightest damp causes their deterioration. The young emerge fully formed and can give one a nasty bite if indiscreetly handled. They are also devoured by the MONITOR LIZARD as well as by Fish Eagles, otters (Davison), water mongooses, and, no doubt, other carnivores.

They grow quickly during the first three years of their lives, but gradually more slowly, I think, according to the supply of food.

Although very interesting as they are, they should undoubtedly be killed by any means, as apart from their fish-eating proclivities, they are a menace to livestock and humans. It appears that, in areas where it is cold in the winter, they do not feed during the winter months, but begin about the middle of September, and are then particularly dangerous, sometimes coming out of the water to catch their prey in full daylight. They sleep out of water, in the sun or in well sheltered places, and are occasionally met some distance from water. I have seen them catching fish in shallow pools on the Sanyati where fish have become partially stranded through the receding river. They charged through the water at an incredible pace and came out on the other side with various sized fishes, once with a very large Catfish (*Clarias* sp.), which was thrown in the air and caught several times until it was in a suitable position to be swallowed. The others seemed to swallow the fish they had caught without tossing them.

The already mentioned (*Varanus niloticus*, Lin), known in Southern Rhodesia as the LEGOVAAN, but rightly called MONITOR, is a relative of the true IGUANA, which does not live in Africa. There are two closely allied species here; the other is known as the ROCK MONITOR (*Varanus albigularis*, Daud). Only the WATER MONITOR concerns us here. They grow up to a length of 7 feet, but are generally about 4 feet 6 inches to 5 feet when fully grown. They occur in all waters in Southern Rhodesia and are practically omnivorous. Eggs are a favourite diet and they certainly do some useful work in keeping down crocodiles by digging out and devouring their eggs. They also catch and eat fish, frogs, toads, snakes and young cane rats. I should list them as being undesirable near a fish hatchery or nursery, but doing little harm away from such institutions, or fowl yards.

Another creature in this class "Reptilia" of the order *Testudines*, is the WATER TORTOISE (*Pelomedusa subrufa*, Gray), which is found in reservoirs and rivers throughout South Africa. They reach a large size in some of our big rivers and are well known as a nuisance to fishermen who use worms or animal flesh as bait. Their horrible smell on being taken out of the water is sickening, and comes from scent glands situated in the soft mem-

branous skin between carapace and plastron, or top and bottom shells. Their flesh is said by some Europeans in the Union, as well as by Hottentots, to be excellent after removal of the stink glands, and certain of the old Dutch inhabitants of the Northern Transvaal used to beg me to bring in all I caught. I cannot say how they prepared them for food, but I do know that these people were excellent cooks and must have had a way of doing away with the offensive odour.

They are omnivorous and are particular enemies of fish in all stages of their existence. They eat the eggs and fry and can catch quite a large fish by shooting out their necks, which can be extended for some distance. They can inflict very severe bites with their horny jaws. They are said to hold the living prey in their mouths and then scratch the flesh off the bones by their sharp and powerful claws. They feed under water but come to the surface to breathe. They breed in holes under rocks or holes in earth excavated by their own claws and lay their soft-shelled eggs well above water level in holes which are suitable or self-made in hard soil, plastering them over with dampened earth. The young scratch their way out when they hatch. I should rate them as distinct pests which ought to be destroyed wherever found.

Amongst the reptiles, the common WATERSNAKES are the BLACK WATERSNAKE (*Natrix laeviesimus*, Gthr.), GREEN WATERSNAKE (*Chlorophis natalensis*, Sm), and BROWN WATERSNAKE (*Ablabophis rufulus*, Licht).

The watersnake is a well-known fish pest and is much more common on our rivers and dam banks than is realised. They are non-poisonous and kill their prey by constriction. Most fishermen in this country have seen one swimming across a river with its head just above the water, but as all snakes are killed on sight in this country, irrespective of their usefulness or otherwise, it is perhaps superfluous to advise anglers to spare them or not. A word for the PYTHON. I must own that to come across a large python amongst the reeds or rocks when looking for a place to fish from is disturbing; but unless molested, this snake does more good than harm, and I am glad to see that an effort is being made to teach people to value these gradually disappearing fauna, which once lost are irreplaceable. One thing is certain, although they at times are found in the water and always near it, they do not molest fish, and their stomachs when examined show very little except remains of rats, dassies or cane rats. Their digestive juices act so quickly that small bodies are soon assimilated and become unrecognisable.

Amongst the *Bactrachians*, the before-mentioned platanna, or HORNED TOAD (*Xenopus laevis*, Daud) is the fish preserver's worst enemy. A slimy, ugly brute with a capacious mouth and insatiable appetite, it destroys more small fish than perhaps any

other creature. It is practically impossible to keep them out of waters where fish can live, and it is truly surprising how many young fish they can destroy. Some people (who should know better) have insisted on their being thrown back into the water when netted with young fish, and in breeding ponds for black bass and blue gills they seem to grow larger than elsewhere These large frogs must take a dozen small fish a day at least, and their only enemy seems to be Cormorant, which, as I have already stated, appears to live on them. They wander about at night during heavy rains and so get into places which have been free of them. They appear to infest all sweet waters from the Cape to Central Africa. Waters with a certain degree of salinity seem to be free of them. This may be a possible method of getting rid of them in ponds where it is proposed to breed fish. They bury themselves in the mud where ponds dry up in the winter season, and where a certain amount of moisture remains they live under stones and logs.

The large BULLFROG (*Rana adspersa*, Tschudi) does not catch fish and is generally found in small enclosed waters and not in rivers. It can and does swallow a duckling occasionally, and, considering its size (many of them would fill a large soup plate), it is a wonder where it finds sufficient food to keep it alive. It also wanders during rainy nights and is often squashed by motor cars travelling on main roads. Its ability to bite is unquestionable, and the two bony protuberances in the front of its jaws enable it to hang on to and even inflict a wound on a human hand.

The commoner green, water and tree frogs and the toads do not molest fish, and their spawn and tadpoles are useful as fish food.

Amongst the insects, there are one or two which kill fish and which are equipped with a stabbing and sucking apparatus and front legs adapted as claspers, belonging to the *Hemiptera*. The large WATER SCORPION is the chief offender in this respect, but there are others, notably the WATER BOATMEN and WATER SCORPIONS of various species. Aquarists are especially warned about what insects they allow in their aquariums, and should consult books or entomologists interested in this family of insects. The WATER BEETLES (*Dysticidae*), kill and eat fish, both in their beetle form and as larvae. The large (*Cybister laterimarginalis*, de G.), or a form of it, is common in Southern Rhodesia and has a wonderfully arranged sucking apparatus. The mandibles have small ducts through them which allow a digestive juice to be forced into the prey when bitten. The insect then sucks the predigested food through the apertures until only the shell or skin is left One sees them occasionally come to the surface for a fresh supply of oxygen and almost immediately disappear again to the bottom or the weeds. They should be destroyed whenever possible.

There is also a genus of spiders which prey on fish and actually catch them under water.

Dr. Hewitt informs me: "The common fish-eating spider of our region is a species of THALASSIUS (*Th. spenceri* especially), and it belongs to the family PISAUSIDAE." Anyone wishing to know more about this spider should refer to the Annals of the Natal Museum, Volume V, Part 1, 1923, called "Observations on Fish- and Frog-Eating Spiders of Natal," by the Rev. Wendick Abraham.

In conclusion, I append a list of animals which are deleterious from a fish-preserving point of view:—

- The Crocodile
- Otters
- The Water Mongoose
- The Snakebird
- The White-Breasted Cormorant
- The Watersnakes
- The Giant Kingfisher
- The Grey- and Black-Headed Herons
- The Fish Eagle
- The Osprey
- Pels Fishing Owl
- The Fresh Water Crab
- Water Scorpions
- Water Tortoises

I am only referring here to waters where fish are being preserved, but sincerely hope that where the birds included can claim to rarity or can be frightened off they will not be killed on sight. Care should be taken not to upset the balance of nature, and in the case of the birds of prey, their interest value is worth more than the fish they catch.

I have to thank Mr. Davison, Game Warden of the Wankie Game Reserve, for hints which I have included in this paper, and Miss Estelle Dell for patiently typing it.

Electric Curing of Tobacco

By THE TOBACCO RESEARCH BOARD OF SOUTHERN RHODESIA.

1. **Experimental Work.** In August, 1945, the Tobacco Research Board invited representatives of the Salisbury Municipality and the Electricity Supply Commission to meet the Board to discuss a report by Mr. J. S. Clinton, former City Electrical Engineer of Salisbury, on the possibility of the application of electricity to curing Virginia Tobacco in Southern Rhodesia. It was decided at this meeting that a full-scale experiment should be carried out on a standard 16 x 16 x 20 ft. tobacco barn, the Electricity Supply Commission and the Tobacco Research Board each to bear 50 per cent. of the cost, whilst the Salisbury Municipality would loan equipment and instruments and provide the electrical power connection.

It was not until early this year, however, that the plant was ready for operation, and the experiment could commence. About 30 acres of tobacco had been planted at the Hillside Experimental Station, Salisbury, and in spite of the difficulties created by drought conditions, over 5,000 lbs. of tobacco were successfully cured. A full and detailed account of the experiments is at present being prepared jointly by the Electricity Supply Commission, who conducted the technical investigation, and the Tobacco Research Board, who supervised the tobacco curing—and this report will be made available in due course.

Since this report is likely to take some considerable time to prepare for publication, however, and because certain broad conclusions have already been reached and will not be materially altered subsequently, the Board feels that immediate publication of these conclusions would be of some value to the industry.

The primary objects of the tests were:—

(a) To verify that there would be no major difficulties in applying electricity to tobacco curing.

(b) To determine the factors which affect the economy of curing by electricity.

(c) To evolve a simple and efficient technique for general application.

As a result of the work carried out, it has become evident that electrical curing of tobacco is an economic proposition, subject, of course, to the stability of the tobacco market, and that certain fundamental principles must be adopted in the layout and design of barns operated by electricity for maximum economy.

It is proposed, therefore, to describe in brief the underlying requirements.

2. **Choice of Process.** Tobacco curing being fundamentally an "intermittent" process—that is to say, each charge of tobacco is treated on its own and in an entirely different manner, perhaps, from the next charge—it would not be possible to apply a continuous process such as a long tunnel, with the tobacco being fed in at one end and being removed, cured, at the other. The main consideration, therefore, is the size of the charge, and the most suitable dimensions of the single barn unit required to accommodate it.

It would be a reasonable assumption to suppose that as a result of the experience of the tobacco industry over past years, the 5,000 lbs. green weight unit—sufficient to pack a 16 x 16 x 20 ft. barn—was found to be the most economic size of unit as well as being the largest quantity of tobacco that could be cured reasonably well in one barn with present methods.

However, with forced air circulation as used in an electrical barn, there appears to be no reason why barns should not be packed more tightly, and this can be done by dispensing with the orthodox method of tying sticks, and substituting the following:—

Each 4 ft. stick would be provided with about 90 simple clips into which leaves could be fastened as they are picked in the lands. The sticks would be loaded on to wagons provided with a covered framework in which to hang them, and upon arrival at the barns the sticks would be packed directly into position in the barns.

It is estimated that the weight of tobacco in each barn could be thereby increased threefold—thus giving an output of about 3,000 lbs. of cured tobacco per run.

The advantage of increased output from the point of view of electrical curing would be, firstly, that fewer barns would be required for a given acreage of tobacco, resulting in a reduced capital expenditure on barns and equipment, and secondly, the standing heat losses on the barn would be divided over the larger output, resulting in much lower running costs per pound of cured tobacco.

The major limitations to increasing output, however, would appear to be the availability or otherwise of sufficient ripe tobacco in the lands when required, and the size of the labour force needed to reap this amount of tobacco in one day.

3. Arrangement of Barns. The primary consideration here is the reduction of heat losses from walls to the outside atmosphere, and in order to have as small an outside wall area as possible, barns would be arranged side by side and back to back—a four-barn unit being the most convenient. If the method of packing suggested above proves possible, a four-barn unit could handle the tobacco of 12 ordinary barns.

The losses from outside walls can be still further reduced by arranging the bulking sheds for these units around the barns generally as depicted in Fig. 1.

The choice of the position of the grading sheds is further influenced by the fact that the discharge of moisture-laden air from the barns will be to the grading sheds, making it unnecessary to

introduce any other means of general air conditioning during the curing period.

It is estimated that the maximum amount of heat insulation required will be cavity walls on the outside of the unit and special heat insulation applied to the roof in the form of a ceiling. The inside walls would need little more than a water-proofing coating to prevent moisture absorption.

4. **Air Circulation and Heating.** During the experimental work a great deal of information was ascertained in regard to the manner in which air circulated within a tobacco barn, and as a result of this experience, the present system has been designed. (See Fig. 1.)

It is found to be essential to force air into the tobacco at as many points as possible, and for this reason an air distributing column is located up the centre of the barn. Air under static pressure is projected from slots in the column between each layer of tobacco, and the column is so designed that the air quantity flowing into the bottom layers is greater than at the top, in order that the general condition of the air throughout the barn should be approximately uniform.

Advantage is taken of the natural tendency of air which cools on absorbing moisture from the leaf, to fall, and the withdrawal of air from the barn therefore takes place at the bottom.

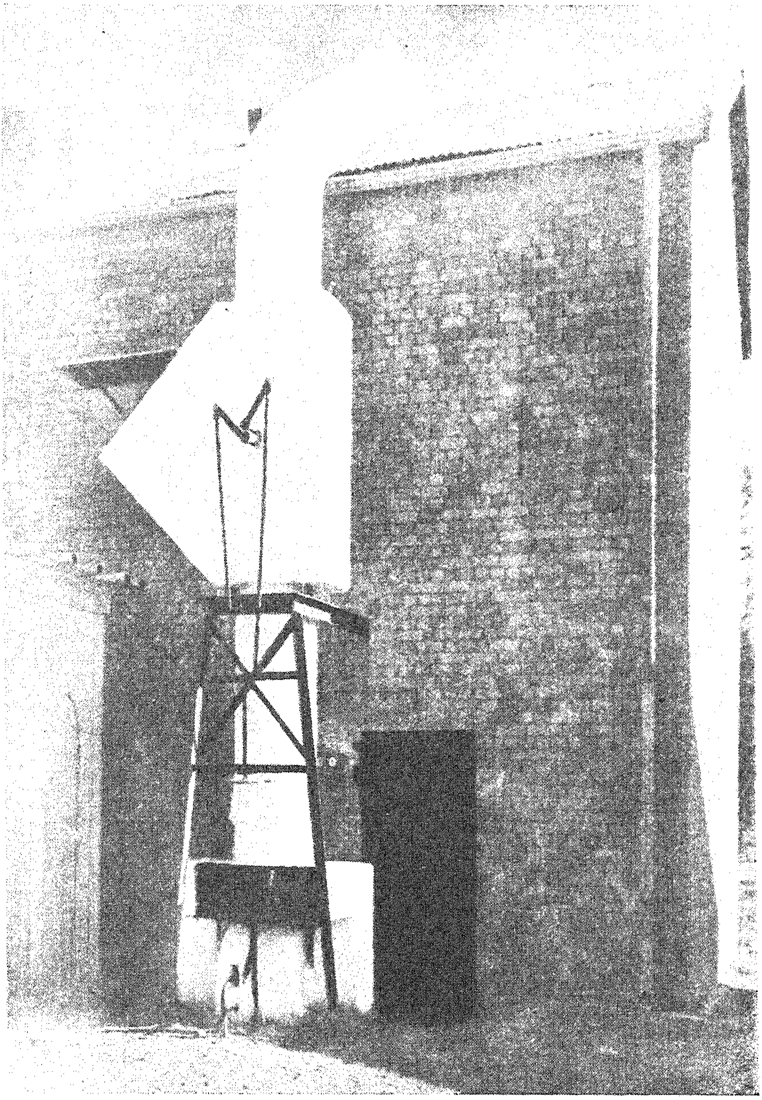
The air quantity used would be approximately 2,000 to 3,000 cubic feet per minute, and the fan would be located just outside the barn.

The heater units, comprising approximately 50 K.W. of spiral type heaters, would be located in the supply trench to the central column. A portion of these heaters will be fixed in capacity and switched on manually as required, while the other portion would be operated automatically by a thermostat to maintain the temperature of the barn constant.

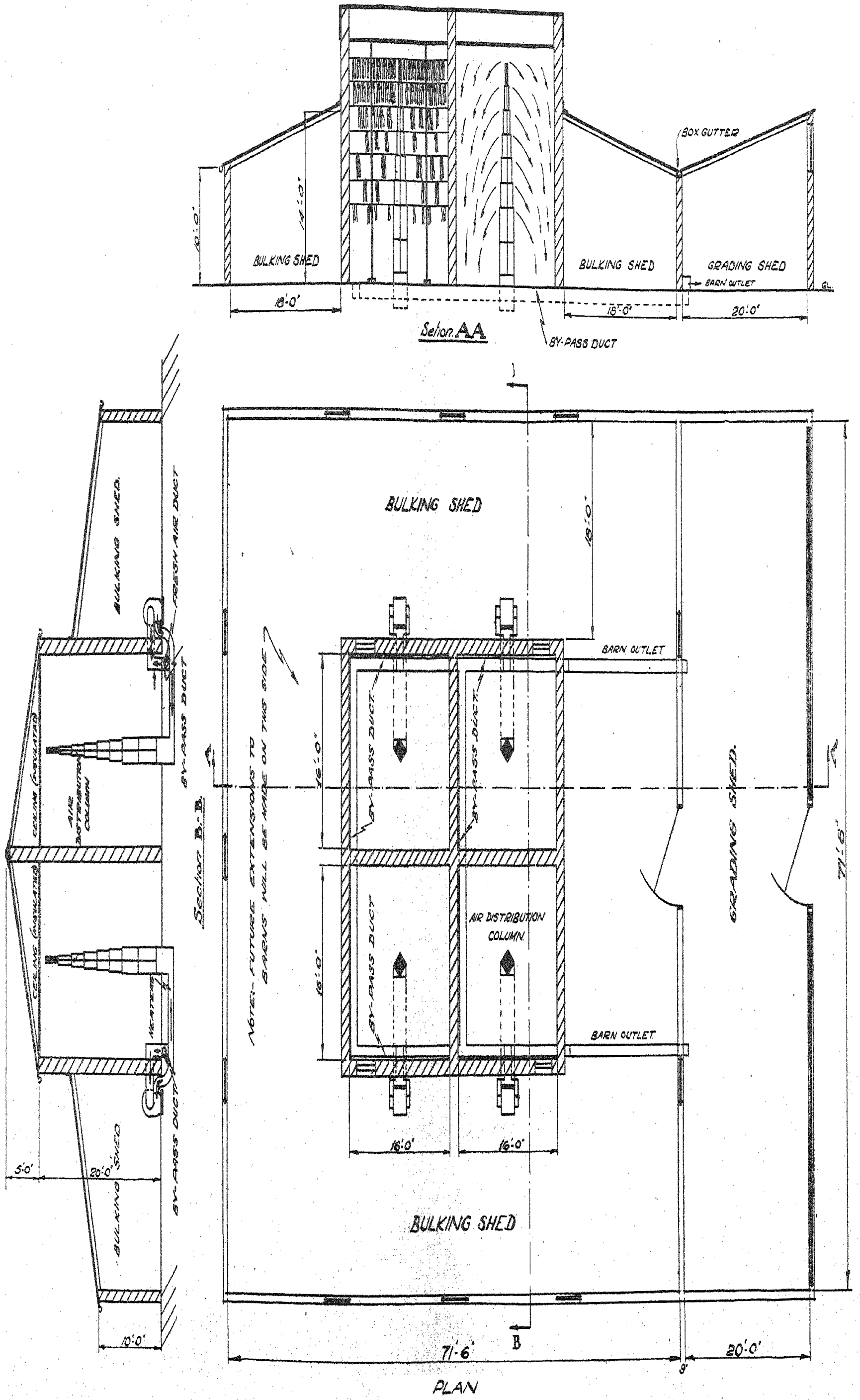
The method of control adopted is such that whereas a divergence of five degrees can be allowed in the temperature of the supply air, the temperature in the barn itself would vary very slightly, if at all.

5. **Heat Economising.** An essential part of the process consists in utilising the moist air ejected from a barn which is drying, to condition a barn which is yellowing at 90 to 105 degrees F. This is accomplished by providing what can be called a by-pass duct running under all barns and into which unwanted air can be discharged. This supply of air will be available to all barns, and its condition will be suitable for barns which are yellowing at low temperatures and require a supply of saturated air.

Furthermore, it is proposed to run a galvanised iron or copper pipe along the length of this trench through which comparatively dry atmospheric air can be drawn. A considerable amount of preheating of the air enclosed in this pipe will take place owing to the heat and condensation of the air around it. Barns which are in the process of drying would draw on this atmospheric air exclusively whilst discharging their moist air into the by-pass duct.



View of Ducting and Heat Exchanger.



PROPOSED LAYOUT OF

FOUR BARN UNIT

Fig. 1

The electrical heating of barns which are yellowing will therefore be negligible, being confined to the small amount necessary to keep the barn temperature constant. Power requirements would be increased, however, at the commencement of drying, even though the air supply at this stage will have been considerably preheated before use in the barn.

6. **Description of Process.** When the barn has been filled to capacity, the fan is started up and the air control set to draw moist air into the barn from the by-pass duct. The controlling thermostat is set to the temperature required, and the barn and contents allowed to get up to temperature. During operation at 90 degrees to 105 degrees the temperature of the air in the by-pass duct should need very little adjustment, and only a small amount of power would be required.

When the leaf is sufficiently yellow and colour fixing is commenced, the air supply is changed over so that the fan is drawing from the atmospheric air main and the barn is discharging into the by-pass duct. Heater capacity has now to be increased to contend with the higher temperature required in the barn.

During this part of the process moist air is expelled from the barn into the by-pass duct, where it cools to a certain extent, giving up some of its heat to the atmospheric air main, and becoming saturated. Part of this supply of air is re-used by other barns in the yellowing stage, whilst the surplus is discharged into the grading shed.

The atmospheric air supply is drawn from the grading shed, and it is worth recording that even if this air is saturated at 90 degrees F., it is sufficiently dry at higher temperatures for injection into barns that are drying.

After the web of the leaf is dry and drying of the midribs is to be commenced, the air supply in the barn is re-circulated without the admission of any additional air until the midribs are thoroughly dry. It is anticipated that with forced air injection the time taken to complete this part of the process should be reduced over present methods and drying at lower temperatures might be possible.

In order to cool the barn and condition the tobacco, the air supply is again drawn from the moist by-pass duct and circulated through the barn until the tobacco is in a suitable condition for handling.

The air change-over control is manipulated by hand near the fan, and is merely a system of opening and closing the appropriate vents to obtain the direction of air required.

7. **Costs.** The cost of equipping a barn for electrical curing would naturally be greater than the cost for the ordinary flue-curing process, but this is offset to a large extent by the fact that the output of the electrical barn is estimated to be at least twice that of the conventional barn, and less than half the number would be required.

In regard to running costs, experiments showed that the electricity consumed by a single singly isolated barn was approximately 3,200 units of electricity per curing. The saving due to the economy

of exposed walls alone would amount to approximately 15 per cent. or 480 units. The heat exchange system adopted is expected to effect a further reduction of approximately 1,000 units in electricity consumption, thus bringing the total figure to 1,720 K.W.H. per barn.

Calling this estimate 2,000 units, and once again placing the output of the barn at double that of the conventional barn, it is expected that the power consumptión can be reduced to one unit of electricity per pound of cured tobacco.

It is necessary to mention that with twice the quantity of tobacco in a barn the overall heat or power consumption is not double by virtue of the fact that major portion of the heat used to evaporate water from the leaf is not lost to the system. Part of the heat is given up to the atmospheric air main by direct conduction and by the condensation which takes place in the by-pass duct; part of the heat is re-used in maintaining one or two barns at 90 degrees to 105 degrees F., and the remainder is passed to the grading shed, where it can still serve a useful purpose in maintaining a humid air condition there. The total losses on the system are those represented by the heat escaping from the grading shed or being conducted away through the walls of the by-pass duct, and, of course, the walls of the barns.

Conclusions. Based on experience gained with electrical curing of tobacco, a process has now been put forward for economic curing, with the following salient features:—

1. Barns are arranged in blocks of four with bulking and grading sheds attached around the perimeter.
2. Tobacco will be picked and clipped directly on to sticks in the land and transported to, and placed straight into, the barn.
3. Forced air circulation through the tobacco will enable a much tighter pack, and it is estimated that the limit is of the order of three times the normal barn corresponding to about 90 leaves per stick.
4. A system of heat transfer from a barn discharging moist air to one requiring low temperature high humidity has been adopted to give maximum economy of heat.
5. Automatic temperature control is utilised.
6. It is estimated that the output of an electric barn could reach the maximum of three times that of the standard flue-cured barn, and therefore affecting a considerable reduction in the number of barns required under present conditions.
7. With the increased efficiency derived from electrically heated barns, the cost of curing tobacco should compare favourably with the present methods of curing.

Analyses of Rhodesian Foodstuffs.

By The Chemistry Branch.

(This replaces Bulletin No. 1214, now out of print.)

A considerable amount of data is available in such valuable textbooks as Henry & Morrison, Hall, Wood, Kellner, and those of many other authors regarding the chemical composition of animal foodstuffs, but these analyses refer to products that have been grown in countries other than our own.

During past years many Rhodesian grasses, legumes, cereals, and other common animal foodstuffs produced and fed in the Colony have been analysed for various purposes in the chemical laboratories of the Department of Agriculture, and it has long been felt that the analytical data available put in the form of a bulletin might be of value to farmers and others.

The increased attention being paid to the feeding of cattle makes the demand for a series of analyses of our commoner foodstuffs more urgent, and it has therefore been decided to issue the following tables, as it is felt that the information contained therein will be of value in assisting farmers in compiling suitable balanced rations for stock from the foodstuffs available on their farms.

In most textbooks giving the analyses and nutritive ratios of foodstuffs the latter are usually computed from the digestible and not from the crude nutrients.

No digestibility trials on cattle have ever been carried out in this Colony, therefore no data are available to show the digestibility of any of our common foodstuffs.

In the circumstances, the nutritive ratios shown in the last column of these tables have been calculated on the crude nutrients, and, although not in accordance with the usual method adopted, it is considered that they will prove useful in classifying foodstuffs, as they show the relative proportion of proteins to carbohydrates and fats.

Calculations. The Protein Factor. The protein content of foodstuffs is ascertained by determining the nitrogen content and multiplying this figure by the factor 6.25.

This factor is derived from the assumption that the whole of the nitrogen present in foodstuffs is in the form of protein and that all proteins contains 16 per cent. of nitrogen, i.e., $\frac{100}{16}$. This figure is fairly accurate for animal proteins, but is only roughly correct for vegetable proteins, as these latter contain more nitrogen than animal proteins. Factors varying from 5.5

to 6.25 have been suggested for different vegetable proteins, but although 6.25 is too high for a number of these, this factor has been used for calculating the protein content of all the foodstuffs in the following tables except wheat, where the factor is 5.7.

The Nutritive Ratios in these tables are calculated by adding to the percentages of carbohydrates and fibre, the percentage of fat multiplied by 2.3, and dividing the sum by the percentage of crude protein, so arranged that the numerator is unity. Thus:—

$$\text{Nutritive Ratio} = \frac{\text{Crude Protein.}}{(\text{Fat x } 2.3) + \text{Soluble Carbohydrates} + \text{Fibre.}}$$

$$= \frac{1}{\dfrac{(\text{Fat x } 2.3) + \text{Soluble Carbohydrates} + \text{Fibre.}}{\text{Crude Protein.}}}$$

PERCENTAGE COMPOSITION OF RHODESIAN FOODSTUFFS.

I.—CONCENTRATES.

(a) Grains and Seeds.

	Moisture.	Ash.	Crude Protein.	Ether Extract.	Fibre.	Carbo-hydrates.	Nutritive Ratio.
	%	%	%	%	%	%	
Belhambra (Monkey Grape) (Fruit)	9.8	3.6	13.6	4.3	10.4	58.3	1:5.8
Buckwheat	9.14	2.55	10.50	2.56	14.45	60.80	1:7.7
Cotton Seed	7.9	3.6	19.0	16.9	23.6	29.0	1:4.8
Flax Seeds	4.6	4.2	20.6	35.7	8.6	26.3	1:5.7
Kaffir Corn (2 analyses)	10.92	1.64	10.90	2.48	2.17	71.89	1:7.3
Linseed Grain (white flowering)	6.97	3.84	22.75	30.23	5.67	30.54	1:4.6
Maize (Dent)	7.0	1.3	9.4	4.5	1.9	75.9	1:9.1
Maize (Flint)	7.4	1.8	10.9	5.3	1.9	72.7	1:7.8
Maize (Hickory King) ...	9.8	1.2	9.3	4.4	1.4	73.9	1:9.2
Maize (Salisbury White)	10.2	1.4	9.3	4.7	1.5	72.9	1.9.2
Milo Maize	8.74	1.57	10.98	2.67	2.66	73.38	1:7.6
Muguruzwuzwu Seeds... ...	18 6	1.9	12.0	21.7	5.0	40.8	1:8.0
Niger Oil Seeds	5.7	6.5	23.7	18.5	29.3	16.3	1:3.7
Nyouti (Munga)	9.42	2.18	11.37	4.31	1.57	71.15	1:7.3
Oats, Hull-less...	11.43	2.13	21.00	7.81	2.00	55.63	1:2.8
Oats, Kherson	9.51	3.90	15.31	5.32	11.26	54.70	1:5.1
Oats, Kinvarra...	9.66	3.92	12.25	8.70	13.71	51.76	1:7.0
Panicum sp. (Native grass seed)	11.12	2.20	8.18	1.55	3.48	73.47	1:9.8
Pumpkin seeds	5.54	3.93	33.91	39.57	15.05	2.00	1:3.2
Rapoko	10.58	3.16	7.62	1.30	2.88	74.46	1:10.8
Rice, Native (Grain)	10.1	1.2	7.4	1.1	...	80.2	1.11.2
Rice, Native (Hulls)	6.9	12.9	4.1	3.5	37.6	35.0	1:19.7
Sunflower heads	10.49	5.15	12.25	12.90	24.52	34.69	1:7.3

(a) Grains and Seeds.—(Continued).

	Moisture.	Ash.	Crude Protein.	Ether Extract.	Fibre.	Carbo-hydrates.	Nutritive Ratio.
	%	%	%	%	%	%	
Sunflower seed (black sel.)	5.76	2.28	14.37	26.77	25.24	25.58	1:7.8
Sunflower seed (white sel.)	5.54	2.61	16.63	24.86	25.99	24.37	1:6.5
Vegetable Ivory Palm Fruit—							
Kernel	7.3	2.3	6.1	4.8	24.1	55.4	1:14.7
Husk	7.4	2.4	2.8	0.7	50.6	36.1	1:31.5
Vi-Vi (Lucaena glauca) seed	9.0	4.0	32.6	6.8	10.4	37.2	1:1.9
Wheat (Jubilee)	11.4	2.1	13.2	2.4	2.0	68.9	1:5.8
Wheat (Kenya Governor)	11.3	2.0	12.4	2.2	2.5	69.6	1:62
Wheat (Punjab)	10.2	2.1	10.8	1.6	2.1	73.2	1:7.3
Wheat (Sabanero)...	10.2	2.4	13.2	1.6	2.8	69.8	1:5.8
Wintersome seeds...	9.9	2.1	11.4	3.6	3.6	69.4	1:7.1

(b) Miscellaneous Concentrates.

	Moisture.	Ash.	Crude Protein.	Ether Extract.	Fibre.	Carbo-hydrates.	Nutritive Ratio.
Avocado Pear (flesh)... ...	69.4	1.2	1.7	15.6	1.6	10.5	1:28.2
Avocado Pear (seed)	69.6	1.2	1.7	1.0	1.2	25.3	1:16.9
Brewer's grains...	5.8	3.7	18.4	7.0	20.1	45.0	1:4:4
"Butu" from Nyouti	4.7	19.8	13.0	4.9	5.5	52.1	1:5.3
Cassava Cake (5 analyses)	9.6	2.2	1.3	0.4	4.9	81.6	1:66.7
Coffee bran	11.9	4.3	2.0	0.2	60.3	21.3	1:4.1
Copra Cake, poorly expressed	4.9	4.2	13.1	33.3	8.7	35.8	1:9.2
Copra Cake, well expressed	9.8	6.7	25.8	8.2	12.7	36.8	1:2.7
Corn and Cob meal	12.4	1.4	8.3	4.1	4.7	69.1	1:10.0
Cotton seed cake	7.3	4.9	33.6	13.3	13.4	27.6	1:2.1
Cotton Seed Meal	5.5	6.6	48.8	11.0	28.1		1:1.1
Dried Fish Meal	6.0	25.4	57.2	10.6	0.5	...	...
Germ Meal	12.1	2.8	9.1	5.3	3.6	67.2	1:9.2
(2 analyses) Ground Nut Cake	6.2	4.1	45.9	16.2	4.5	23.1	1:1.4
(decorticated) Hominy Chop	10.26	1.48	8.75	4.56	4.90	70.06	1:9.8
(3 analyses) Kaffir Beer Residue	9.6	2.0	15.2	4.1	69.1		1:5.2
Linseed Cake	6.6	7.8	32.9	9.6	9.9	33.2	1:2.0
(2 analyses) Linseed Oil Cake	6.8	9.0	34.6	7.9	10.5	31.2	1:1.7
Locust Meal	7.06	6.84	47.47	22.91	10.81	4.91	1:1.4
Lucerne Meal, dehydrated	4.6	8.1	24.5	3.3	27.5	32.0	1:2.7
Maize Alcohol Residue ...	10.1	4.3	27.8	12.1	8.8	36.9	1:2.7

(b) Miscellaneous Concentrates.—(Continued)

	Moisture	Ash	Crude Protein	Ether Extract	Fibre	Carbo-hydrates	Nutritive Ratio.
	%	%	%	%	%	%	
Maize Bran	8.4	1.8	7.9	5.6	14.8	61.5	1:11.3
Maize Screenings...	10.6	1.9	9.1	5.5	6.3	66.6	1:9.4
Malt Culms	7.0	5.8	22.3	0.9	14.1	49.9	1:3.0
Mealie Meal... ... ... (3 analyses)	10.22	1.30	8.58	4.69	1.96	72.61	1:9.9
Mimosa Meal	7.06	4.15	11.25	0.92	21.18	55.44	1:7.0
Molasses...	30.6	5.8	1.3	0.6	6.0	55.7	1:49
Munga Bran	7.9	8.5	13.2	8.4	3.7	58.3	1:6.2
Palm Kernel Cake ... ... (4 analyses)	7.2	2.7	13.9	17.6	18.4	40.2	1:7.1
Pumpkin Seed Cake	4.6	5.6	46.8	11.2	17.5	14.3	1:1.2
Pumpkin Waste, dehydrated	4.4	6.0	26.9	23.1	10.8	28.8	1:3.4
Rice Bran ... ... (2 analyses).	5.3	14.5	7.2	4.0	27.4	41.6	1:10.9
"Seepu"	9.92	13.91	12.19	2.30	10.19	51.49	1:5.2
Soya Bean Cake ... ... (2 analyses)	9.9	5.8	42.9	8.8	4.5	28.1	1:1.2
Soya Bean Meal (pods and seeds)	8.8	6.6	24.1	10.0	17.3	33.2	1:3.0
Sunflower Heads, seeds removed	11.73	11.62	8.86	3.18	18.19	46.42	1:8.1
Wheat Screenings...	8.8	7.2	11.2	2.1	13.4	57.3	1:6.7

(c) Slaughter-house By-products.

Blood Meal ... ... (8 analyses)	9.7	3.3	83.5	.6	1.0	...	...
Bone Meal ... ... (8 analyses)	5.4	60.0	27.4	4.9	1.4	...	...
Meat Meal or Meat and Bone Meal ... ... (13 analyses)	6.1	18.4	60.0	12.5	2.0	...	...
Tripe Cracklings	6.9	4.9	8.06	7.0	2.0	...	...

(d) Leguminous Pods and Seeds.

Acacia albida (entire pods)	7.1	3.4	11.1	1.4	27.5	49.5	1:7.2
Acacia arabica (entire pods)	9.2	4.0	10.9	2.9	15.7	57.3	1:7.3
Acacia benthami (beans)	6.96	3.45	12.56	4.57	9.46	63.00	1:6.6
Acacia benthami meal... ...	7.6	3.9	13.1	1.8	14.0	59.6	1:5.9
Acacia gerrardi pods... ...	10.9	4.6	18.7	1.2	24.6	40.0	1:3.6
Acacia lasiopetala pods ...	5.3	4.4	14.7	1.0	25.9	48.7	1:5.2
Acacia sp. (entire pods)...	8.58	5.65	14.22	1.48	21.55	48.52	1:5.2

(d) Leguminous Pods and Seeds.—(Continued).

	Moisture.	Ash.	Crude Protein.	Ether Extract.	Fibre.	Carbo-hydrates.	Nutritive Ratio.
	%	%	%	%	%	%	
Afzelia quanzensis (Pod Mahogany)	5.0	4.3	5.9	5.3	42.0	37.5	1:15.4
Albizzia amara (entire pods)	9.31	3.29	12.25	6.89	32.69	35.57	1:6.9
Bauhinia macrantha	6.0	3.3	5.4	0.6	36.5	48.2	1:15.9
Bauhinia thonningii (entire pods)	6.1	3.9	6.6	3.1	23.7	56.6	1:13.2
Camelthorn (Acacia giraffeae) (entire pods)... ...	9.36	3.29	11.37	1.61	30.98	43.39	1:6.9
Carob bean (Ceratonia siliqua) (pods without seeds)	5.68	2.25	3.24	2.09	9.90	76.84	1:28.3
Carob bean (seed)...	8.14	3.44	16.38	2.55	7.93	61.56	1:4.6
Carob bean (entire pods)...	6.10	2.45	5.48	2.17	9.56	74.24	1:16.2
Cassia abbreviata	5.9	3.5	9.2	0.4	48.4	32.6	1:8.9
Cassia laevigata...	6.2	4.1	13.2	2.3	21.2	53.0	1:6.0
Cowpeas, or Kaffir beans (seeds)	13.9	3.4	23.4	1.8	5.9	51.6	1:2.6
Cowpea Pods (without seeds)	6.7	3.2	9.5	0.6	37.4	42.6	1:8:6
Dahl (seeds)	7.0	3.8	21.0	1.3	9.1	57.8	1:3.3
Dahl (complete pods)... ...	7.2	4.6	13.3	1.3	17.9	55.7	1:5.8
Dichrostachys glomerata ..	7.6	4.8	18.1	1.9	21.4	46.2	1:4.1
Dolichos bean (seed)	8.03	3.90	24.72	1.00	9.77	52.58	1:2.6
Gram, large white (seed)	5.66	2.34	20.13	5.74	2.41	63.72	1:3.9
Gram, brown (seed)	6.31	2.64	21.90	4.37	10.81	53.97	1:3.4
Gram, horse (seed)	4.3	6.8	23.6	0.6	7.5	57.2	1:2.8
Ground Nuts—							
Rhodesian Valencia—							
Entire pods...	7.36	2.35	24.71	36.31	16.02	13.25	1:4.6
Husks	10.65	3.06	4.81	0.98	61.16	19.34	1:17.2
Kernels	6.36	2.14	30.79	47.10	2.23	11.38	1:4.0
Virginia Bunch—							
Entire pods	8.82	2.64	22.07	32.90	18.12	15.45	1:4.9
Husks	10.84	2.40	4.58	1.09	64.50	16.59	1:18.2
Kernels	8.15	2.73	27.94	43.57	2.56	15.05	1:4.2
Madagascar Butter Bean (entire pods)	9.3	3.6	11.8	1.8	26.0	47.5	1:6.6
Mnondo (Isoberlinea globiflora) pods	7.5	3.2	6.5	0.9	43.5	38.4	1:12.9
Mung Bean (black-seeded) (seeds)	4.4	6.5	26.3	0.6	4.3	57.9	1:2.4
Natal Sugar Beans...	5.9	3.6	21.8	1.3	5.6	61.8	1:3.2

(d) Leguminous Pods and Seeds.—(Continued)

	Moisture	Ash	Crude Protein	Ether Extract	Fibre	Carbo-hydrates	Nutritive Ratio.
	%	%	%	%	%	%	
Nyomo (bean)	9.4	3.6	16.3	6.8	5.7	58.2	1:4.9
Somerset Velvet Beans (beans only)...	11.0	3.1	22.9	5.1	5.7	52.2	1:3.0
Somerset Velvet Beans (entire pods)...	10.4	3.4	13.3	3.0	14.3	55.6	1:5.8
Soya Bean. Biltan (seed)	7.8	4.1	40.3	16.1	4.9	26.8	1:1.7
Soya Bean. Herman (seed)	8.1	4.4	36.7	18.7	4.9	27.2	1:2.0
Soya Bean. Otoxi (seed)	7.9	4.2	45.2	16.6	4.4	21.7	1:1.4
Sunnhemp (seed)	7.6	3.6	29.4	3.5	11.1	44.8	1:2.2
Swartzia madagascariensis (entire pods)	8.86	2.43	5.69	1.12	21.10	60.80	1:15.0
Sword Bean (Canavallia ensiformis)—							
Beans only	7.1	3.2	27.6	1.5	11.8	48.8	1:2.3
Pods only	7.9	4.7	9.5	0.5	28.6	48.8	1:8.3
Complete (bean and pod)	7.8	4.6	14.0	0.9	23.9	48.6	1:5.3
Upright Cowpeas	11.1	3.8	22.3	1.4		61.4	1:2.9
Velvet Bean (White Stingless) (seed)...	10.18	3.5[illegible]	26.94	6.13	3.11	50.10	1:2.5
Velvet Bean (White Stingless) pods without contained seeds...	9.49	5.06	4.19	0.98	27.27	53.01	1:19.7
Velvet Bean (White Stingless) (entire pod) ...	9.87	4.21	16.89	3.85	13.78	51.40	1:4.4
Vi-Vi (Lucaena glauca) (entire pods)	19.5	4.7	17.5	1.1	20.6	36.6	1:3.4

II.—DRIED ROUGHAGE.

(a) Hay from Grasses, etc.

	Moisture	Ash	Crude Protein	Ether Extract	Fibre	Carbo-hydrates	Nutritive Ratio.
Bermuda Salt Bush (Osteospernum muricatum) ..	9.9	9.4	10.9	3.9	27.6	38.3	1:6.8
Black Turf grass (Ischaemum glaucostochyum)	13.19	9.15	9.56	1.80	32.09	34.21	1:7.2
Buffalo grass (Setaria chevalieri)	9.40	11.16	11.25	2.06	24.87	41.26	1:6.3
Chloris virgata (old lands grass)...	12.15	9.91	9.07	1.55	30.02	37.30	1:7.8
Climbing Belhambra (Phytolacca octandra)... ...	13.9	11.3	22.8	2.1	15.0	34.9	1:2.4
Common Buffel or Guinea grass (Panicum maximum)	13.11	11.74	12.38	1.49	23.13	38.15	1:5.2
Crowsfoot Grass (Dactyloctenium aegyptium) ...	8.7	5.9	7.6	0.7	33.0	44.1	1:10.4
Digitaria setivalva	11.30	10.13	11.69	2.30	24.54	40.04	1:6.0

(a) Hay from Grasses, etc.—(Continued).

	Moisture	Ash	Crude Protein	Ether Extract	Fibre	Carbo-hydrates	Nutritive Ratio.
	%	%	%	%	%	%	
Dryland grass (Pennisetum ciliare)	10.57	11.60	14.83	1.66	23.50	32.79	1:4.4
Galinsoga parviflora	6.5	9.6	21.9	2.0	60.0		1:2.9
Giant Rhodes Grass (Chloris gayana at Silage Stage)	7.5	6.2	13.0	2.1	71.2		1:5.8
Gonya grass (Urochloa bulbodes)	10.74	11.54	15.81	1.77	21.98	38.16	1:4.1
Gonya grass (Urochloa mosambicensis)	11.53	11.36	13.06	1.32	24.71	38.02	1:5.0
Hunyani grass (Chloris gayana) creeping strain	9.90	8.36	9.31	1.74	28.83	41.86	1:8.0
Kikuyu	5.9	9.6	10.2	1.2	31.7	41.4	1:7.4
Kokoma	9.7	9.9	8.3	1.5	30.6	40.0	1:8.9
Limpopo grass, S.A.; Antelope grass, Rhod. (Echinochloa pyramidalis)	17.55	8.41	12.88	1.99	27.55	31.62	1:4.9
Maize Sheaths	8.1	3.9	8.0	0.7	25.7	53.6	1:8.9
Complete Maize Plant minus Sheaths	9.7	5.0	5.1	0.8	26.9	52.5	1:14.0
Manna Hay	6.2	7.3	7.0	1.2	30.2	48.1	1:11.6
Milanje grass (Digitaria milanjiana)	10.41	8.23	11.19	2.12	26.16	41.89	1:6.5
Napier Fodder...	7.4	8.4	9.0	1.4	34.6	39.2	1:8.6
Purple topped Buffel (Panicum maximum)	12.64	11.48	14.13	1.60	21.48	38.67	1:4.5
Rapoko grass	11.08	8.40	11.00	1.57	28.84	39.11	1:6.5
Reed Timothy grass (Setaria phragmitoides) ...	11.31	12.08	15.00	1.22	28.39	32.00	1:4.2
Rhodesian Blue grass (Andropogon gayanus) ...	9.53	6.37	10.50	2.29	30.82	40.49	1:7.5
Rhodes grass (Chloris gayana) (5 analyses)	7.9	7.0	8.5	1.2	36.9	38.5	1:8.9
Smooth Rhodesian Tussock grass (Setaria plicatilis)	11.84	8.90	13.69	2.02	29.05	34.50	1:5.0
Setaria pabularis	11.23	12.72	13.00	0.88	29.28	32.89	1:4.9
Spekboom (Portulacaria Afra)	4.4	9.4	8.1	3.6	20.0	54.5	1:10.2
Star Grass (Cynodon plectostachyum)	7.0	5.2	8.7	1.8	35.0	42.3	1:9.4
Sudan	10.1	6.7	8.9	1.3	30.9	42.1	1:8.5
Sunflower plants (complete)	7.74	7.90	11.50	6.79	31.80	34.27	1:7.1

(a) Hay from Grasses, etc.—(Continued)

	Moisture.	Ash.	Crude Protein.	Ether Extract.	Fibre.	Carbo-hydrates.	Nutritive Ratio.
	%	%	%	%	%	%	
Swamp Couch (Haemarthria fasciculata)... ...	17.64	5.79	6.63	1.52	26.68	41.74	1:10.8
Teff Grass	10.9	6.7	10.4	1.7	26.2	44.1	1:7.1
Upright False Paspalum [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Wintersome fodder...	13.3	4.4	4.1	0.8	26.0	51.4	1:19.3
Woolly Finger grass (Digitaria pentzii)	11.46	8.43	14.25	2.01	28.58	35.27	1:4.8

(b) Hay from Legumes.

	Moisture.	Ash.	Crude Protein.	Ether Extract.	Fibre.	Carbo-hydrates.	Nutritive Ratio.
'owpea Hay ... ... (2 analyses)	9.2	6.6	11.1	1.2	28.7	43.2	1:6.2
'owpea Meal (complete plant)	8.2	7.3	18.5	4.0	13.7	48.3	1:3.8
rotalaria intermedia	7.5	5.7	14.4	1.5	33.3	37.6	1:5.2
)ahl	12.00	3.73	20.12	1.80	6.84	55.51	1:3.3
olichos Bean Hay	11.1	6.5	12.1	2.4	21.3	46.6	1:6.1
olichos lupiniflorum... ...	8.2	6.8	17.5	1.1	24.5	41.9	1:3.9
riosema englerianum (Vaalbosch) ... ... (2 analyses)	10.1	5.0	12.1	2.6	26.1	44.1	1:5.1
round Nut Hay	9.5	11.9	10.6	1.3	27.0	39.7	1:6.6
udzu vine (complete) ...	4.52	6.28	13.38	2.43	34.57	38.82	1:5.9
udzu vine (leaves)	8.05	7.13	18.06	3.56	19.81	43.39	1:4.0
udzu vine (stalks)	7.81	5.19	5.29	0.95	42.63	38.12	1:15.7
ucerne Meal ... ... (Lime (CaO) 2.2%)	4.1	10.8	16.3	2.8	29.8	36.2	1:4.4
upinaria	...	...	12.13	...	...	...	...
oya Bean (Biltan) Hay...	15.4	5.8	9.9	3.0	31.6	34.3	1:7.4
oya Bean Hay...	7.41	5.69	13.81	3.48	32.23	37.38	1:5.6
unnhemp Hay (4 analyses)	7.66	5.11	11.42	1.01	42.17	32.63	1:6.8
elvet Bean Hay...	9.3	7.8	13.3	2.5	27.6	39.5	1:4.2
'edge Field Pea	7.2	6.1	22.6	2.4	25.2	36.5	1:3.0

(c) Dried Roughage from Miscellaneous Green Leaves of Trees, Plants, etc.

	Moisture.	Ash.	Crude Protein.	Ether Extract.	Fibre.	Carbo-hydrates.	Nutritive Ratio.
anana leaves	10.2	10.9	12.8	2.0	26.6	37.5	1:5.4
anana stems	12.4	16.2	5.8	1.3	22.7	41.6	1:11.6
ssia laevigata, leaves and stems	8.7	6.8	16.5	6.0	24.2	37.8	1:4.6

(c) Dried Roughage from Miscellaneous Green Leaves of Trees, Plants, etc.—(Continued).

	Moisture	Ash	Crude Protein	Ether Extract	Fibre	Carbo-hydrates	Nutritive Ratio.
	%	%	%	%	%	%	
Dolichos bean leaves... ...	...	...	17.3	...	...	...	...
Dolichos bean stems	...	...	7.25	...	...	...	...
Granadilla leaves	8.92	8.13	15.37	4.64	10.88	52.06	1:4.8
Indigofera, leaves and flowers	...	...	20.0	...	...	...	...
Madagascar Butter Bean, leaves and stalks... ...	9.2	7.4	8.1	3.6	36.9	34.8	1:9.9
M'futi tree leaves	...	...	16.2	...	...	...	...
Mistletoe. Viscum verrucosum?	2.4	9.3	13.3	5.1	21.9	48.0	1:17.4
Mulberry Leaves	16.0	9.7	19.0	3.9	51.4		1:3.2
Paw Paw leaves...	9.7	11.1	22.5	3.9	9.7	43.1	1:2.7
Vaalbosch leaves	6.22	7.99	14.06	8.39	26.44	36.90	1:5.9
Vi-Vi (Lucaena glauca) branches...	13.2	7.0	18.6	2.8	19.3	39.1	1:3.5
Vi-Vi (Lucaena glauca) leaves only	10.4	10.0	17.9	5.8	12.6	43.3	1:3.9
Water Hyacinth (Eichornia crassipes)	7.7	17.3	13.2	1.2	19.1	41.5	1:4.8
Willow leaves (common)...	11.0	5.2	9.8	2.8	17.4	53.8	1:7.9
Willow leaves (weeping)...	13.9	8.8	14.4	2.5	15.5	44.9	1:4.6

III.—FRESH ROUGHAGE.
Roots, Tubers, Fruit, Leaves.

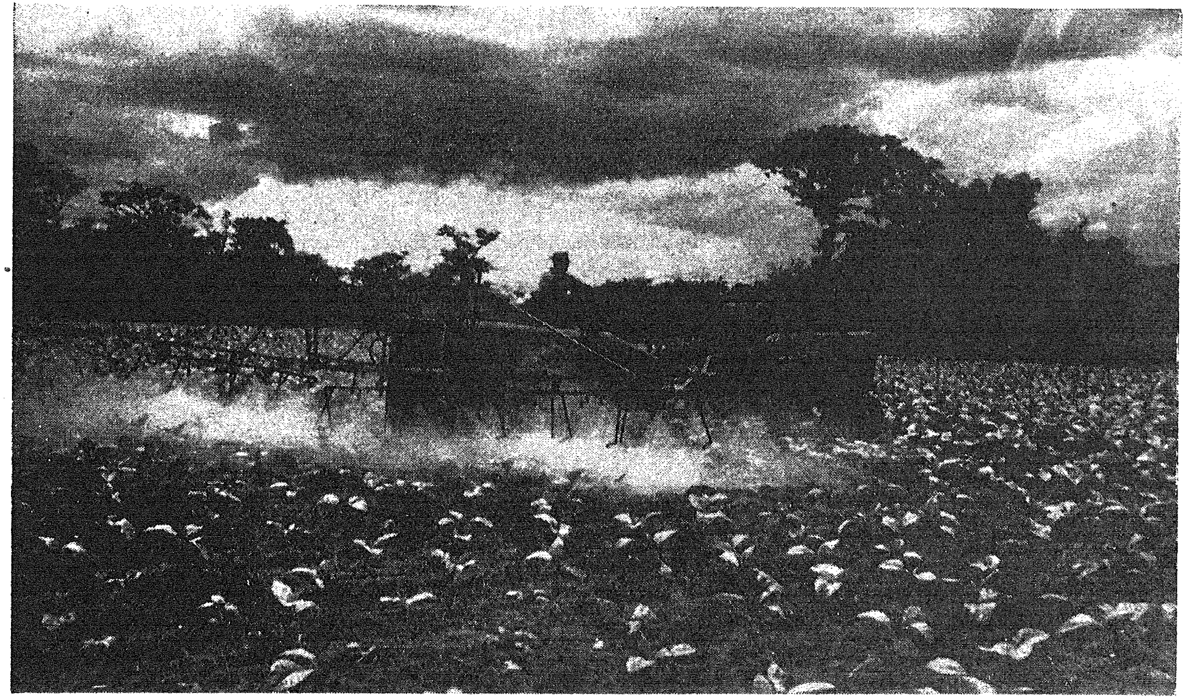
Agave americana leaves...	85.6	1.8	0.7	0.2	2.2	9.5	1:17.3
Edible Canna tubers (first year)	88.1	0.72	0.72	0.03	0.53	9.90	1:15.0
Edible Canna tubers (second year)	84.4	0.60	0.77	0.04	0.63	13.56	1:20.0
Emfenge leaves (Cussonia spicata)	22.1	6.1	6.7	2.7	15.4	47.0	1:10.0
Kigelia pinnata (Sausage tree), fruit only	85.4	0.66	0.84	0.88	4.29	7.93	1:17.0
Lucerne (flowering stage)	74.0	2.0	4.5	0.8	9.5	9.2	1:3.2
Majorda Melon	94.62	0.36	0.44	0.03	0.43	4.12	1:10.5
Prickly Pear fruit, complete	...	...	0.70	...	...	...	...
Prickly Pear fruit, pulp ...	...	...	0.88	...	...	...	...
Pumpkins	86.8	0.90	1.8	0.80	[illegible]	[illegible]	[illegible]

Roots, Tubers, Fruit, Leaves.—(Continued)

	Moisture	Ash	Crude Protein	Ether Extract	Fibre	Carbo-hydrates	Nutritive Ratio.
	%	%	%	%	%	%	
Sunflower leaves	78.70	3.95	4.12	0.70	1.97	10.56	1:3.4
Sweet potato tubers (Early Butter)...	78.70	0.70	1.38	0.16	0.38	18.68	1:14.0
Sweet Potatoes—							
Black Rock...	80.0	0.9	1.7	0.2	0.8	16.4	1:10.4
Calabash Leaf...	80.0	0.7	1.4	0.3	0.6	17.0	1:13.1
Virovsky	80.0	0.7	0.9	0.1	0.8	17.5	1:20.6

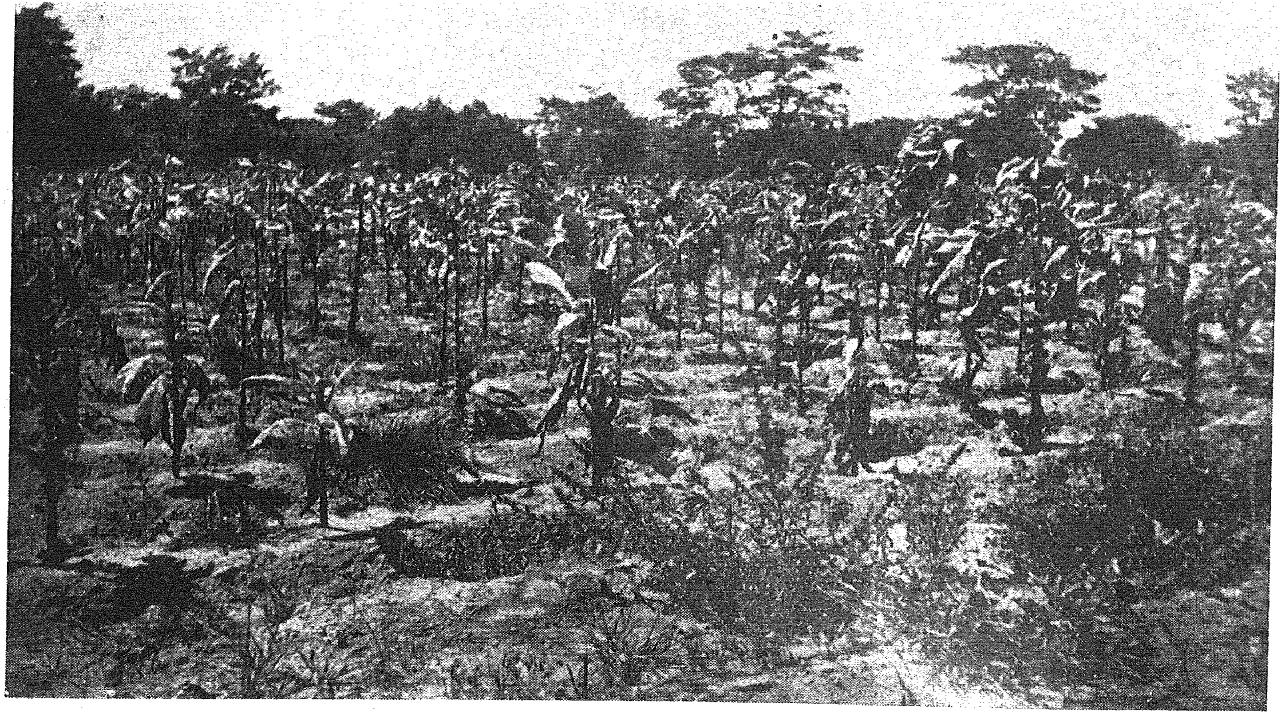
IV.—SILAGE.

	Moisture	Ash	Crude Protein	Ether Extract	Fibre	Carbo-hydrates	Nutritive Ratio.
Dolichos beans—							
Green	76.19	2.12	4.44	1.28	5.25	10.72	1:4.3
Air-dried	11.74	7.87	16.44	4.76	19.45	39.74	
Kudzu Vine—							
Green	62.71	4.33	4.95	1.55	11.59	14.87	1:6.1
Air-dried	13.88	10.00	11.44	3.57	26.77	34.34	
Maize—							
Green	70.79	1.45	2.08	1.68	2.80	21.20	1:13.4
Air-dried	12.13	4.37	6.25	5.08	8.42	63.75	
Napier Fodder—							
Green	73.08	3.67	1.14	0.98	10.49	10.64	1:20.5
Air-dried	10.10	12.26	3.81	3.29	35.03	35.51	
Niger Oil Plant—							
Green	66.80	3.95	4.69	4.99	7.41	12.16	1:6.6
Air-dried	7.27	11.05	13.12	13.96	20.71	33.89	
Sunflower—							
Green...	81.44	2.26	2.94	1.10	3.04	9.22	1:5.0
Air-dried	11.40	10.79	14.06	5.26	14.48	44.01	
Sweet Potato tops—							
Green	82.69	2.14	2.77	0.81	2.65	8.94	1:4.9
Air-dried	11.70	10.92	14.13	4.12	13.54	45.59	
Sunnhemp (green)...	78.24	2.00	2.53	0.69	10.71	5.83	1:7.2
Tango Daisy fodder (Tithonia) (green)	79.0	2.3	1.8	0.3	9.4	7.2	1:9.9
Tango Daisy fodder (Tithonia) (air-dried)	14.9	9.2	7.2	1.4	38.1	29.2	
Veld Grass (Red soil) air-dried (3 analyses)	14.8	7.9	5.7	1.6	26.2	43.8	1:12.9
Veld Grass (Sandveld), air-dried (2 analyses) ...	9.7	7.2	3.7	0.6	40.1	38.7	1:22.0
Vlei Grass, air-dried (3 analyses)	10.6	8.6	5.5	2.3	33.5	39.5	1:14.2
Velvet Bean—							
Green	81.11	2.29	2.94	1.17	5.00	7.49	1:5.2
Air-dried	9.43	11.01	14.12	5.62	23.98	35.84	
Velvet Bean, plus Maize air-dried	7.6	3.1	10.2	3.8	12.9	62.4	1:8.2



Spraying Tobacco during experiments subsidised by the Rhodesia Tobacco Association and the S.R. Government.

[Photo by C. F. Warren.



Granville wilt of Tobacco. The weed in the foreground (Kaffir Spinach) has been proved to be a host plant of the bacterium causing the wilt.

[Photo by J. C. Hopkins.

Seasonal Notes on Plant Diseases.

Field Spraying of Tobacco.

Bacterial Wilt of Tobacco and Other Plants.

By J. C. F. HOPKINS, D.Sc. (Lond.), A.I.C.T.A., and G. R. BATES, Ph.D.

(*Branch of Botany and Plant Pathology*).

FIELD SPRAYING OF TOBACCO.

Experiments on field spraying of tobacco were commenced in Southern Rhodesia as long ago as 1927, and it was found that copper sprays and dusts gave some measure of control of angular spot, wild fire and frog-eye, whilst sulphur dust applied to the soil greatly reduced the incidence of mildew, generally known as white mould.

At that time heavy losses were experienced from these diseases by most growers and field practices for their control were not in general use. In course of time the many new growers gained experience and adopted measures for the elimination of diseases, but even so, losses continued to be severe in any but very favourable seasons. Other methods were required, and experiments on field spraying were again taken up, so that in 1939 this Branch was advocating the use of copper sprays in the field as a routine measure.

During the intervening period another disease generally known as Alternaria (*A. longipes*) began to assume prominence and field spraying operations were directed towards its control. A certain amount of success was obtained, but it became apparent that full control was not likely to be secured with the knapsack pumps, low-pressure potato sprayers and other equipment then in use.

However, in 1945 a commercial firm, Messrs. Pest Control (C.A.), Ltd., began operations in Rhodesia with up to date high-pressure power equipment spraying crops on contract, and a scheme of co-operative experiments with this Branch was drawn up, which was to be subsidised for two seasons by the Government and R.T.A.

The unprecedented drought of last season seriously interfered with the programme, but useful information was obtained on factors affecting operations, whilst distinct indications were observed of control of Alternaria and frog-eye. Complete control of angular spot was also obtained.

The scheme will be continued in the coming season, using a wider range of fungicides and employing various modifications of technique suggested by experience gained last year.

BACTERIAL WILT OF TOBACCO AND OTHER PLANTS.

The existence of this serious bacterial disease, also known as Granville wilt of tobacco, has long been suspected in Rhodesia. Unconfirmed reports of localised outbreaks in tobacco date back more than 20 years. The first authentic case from which the organism was isolated, specifically identified and its pathogenicity confirmed, occurred in February, 1946. It is important to note that a suspected outbreak of bacterial wilt was recorded from the same land exactly ten years earlier. This particular land was fallowed for eight years before replanting to tobacco, despite which the disease reappeared in severe form, as will be seen from the adjoining photograph.

More recently, another case of the disease has been recorded on tobacco, whilst it has also been found attacking tomatoes and potatoes in widely separated parts of the Colony. Most outbreaks so far investigated have occurred on medium to light sandy soils and have been of restricted extent.

Tobacco plants are usually invaded through the roots from infected soil. Damage to the roots during cultivation or transplanting and attack by eelworm tend to encourage infection.

The first symptom in tobacco is a drooping of the leaves which later turn yellow and develop irregular brown spots; finally they become dry and wrinkled and hang down from the stalk. Longitudinal, dark brown streaks may form on the stems. Potatoes and tomatoes generally commence to wilt as they approach the flowering or early fruiting stage. A feature of the disease in all these crops is that wilting of the foliage occurs whilst it is still green. Other characteristic symptoms by which bacterial wilt can be recognised include a dark discolouration of the conducting vessels and the exudation of a dirty white ooze from such tissues when the stem is cut across close to the ground.

Hot, dry weather favours the onset of the wilt symptoms, although the disease spreads and develops more rapidly in wet weather.

Control of bacterial wilt is rendered difficult by the wide host range of the organism. For example, it has been found naturally infecting "kaffir spinach" (*Amarantus graecizans*, L.), a common weed of tobacco lands. The high persistence of the bacterium in land fallowed for eight years is possibly explained by this ability to attack various weeds.

Fortunately, crop plants of the grass family, the grasses themselves and certain leguminous plants are either immune or resistant to the disease. In this connection it is reported from the U.S.A. that a considerable reduction in the incidence of bacterial wilt was obtained by triennial rotations with maize, soya beans or grass. The complete elimination of the disease by this system, however, appears unlikely. Chemical treatments against bacterial wilt have been tried, but are uneconomic on a large scale.

The disease is soil-borne and can easily be spread by transferring soil from infected to clean lands on the feet of humans or animals, by implements, and on the wheels of tractors, farm vehicles, etc. It may also be distributed by flood water, irrigation and during transplanting.

Local investigations regarding the disease are in progress. A wilt-resistant tobacco variety is under trial, whilst various leguminous cover-crops are being tested with regard to their behaviour in infected soil. It is still uncertain whether more than one strain of the organism is implicated with the disease in Rhodesia, and this point is being further studied.

Kraal Compost

By S. D. TIMSON, M.C., Agriculturist.

[Bulletin 1203 Revised.]

This method of making compost is the simplest, and, as twelve years experience has shown, the best for local farming conditions. In particular it is to be recommended because it conserves the most important liquid portion of the manure without the aid of expensive drains, sumps and pumps.

It consists simply of placing the raw materials (crop wastes, grass, etc.), under the feet of stock for a time, adding a little soil, and wood ashes or agricultural lime, and then building these materials into heaps of suitable size. The heaps are then turned over several times by forks.

The feet of the stock perform important work in breaking up hard wastes such as maize, tobacco, sunflower and cotton stalks, thus enabling the fungi and later the bacteria to penetrate these materials and rapidly bring about their breakdown.

The other and most essential function of the stock, of course, is to supply in their dung and urine the necessary quantity of food (particularly nitrogen) for the fungi and bacteria that break down the wastes. Our farm wastes commonly contain less nitrogen than these micro-organisms require as food to carry on their work expeditiously and it must be made up to ensure that the compost is made within a reasonable time so as to fit conveniently into the farming year, whether the compost is made in summer or in winter.

RAW MATERIALS REQUIRED.

1. **Wastes.** Any waste materials such as wheat and maize threshing wastes (husks, stalks and cores), sunflower stalks, cotton stalks, leaves of trees of all kinds (except coniferous trees), green or dry veld grass, and the top growth of crops grown for the purpose, such as Napier fodder, or a mixture of sunn hemp and munga. A moderate proportion of sawdust, wood shavings and leaves of coniferous trees can be included.

2. **Soil.** Soil soaked in urine obtained from kraals, cattle standings, etc., is best. Next best is antheap soil. If these two are not available use ordinary soil, including that which collects

as a result of erosion of the arable land. Heavy soil is better than light sandy soil; but use the soil from the nearest source as far as possible in order to save cartage.

3. **Wood Ashes or Agricultural Lime.** Unleached wood ashes are preferable to lime, because they contain useful quantities of potash and phosphates. If oil drums or other receptacles are placed in the native compounds large quantities can be obtained from this source. Leaching by rain washes out most of the potash.

The soil is added to assist the retention of moisture in the heap; to supply the necessary micro-organisms which bring about decay; to supply part of the bases (lime, etc.) required by the micro-organisms; to temporarily absorb ammonia and so prevent loss of nitrogen.

Lime and wood ashes are added to neutralise the organic acids formed during the decay processes since the micro-organisms best do their work of breaking down the organic wastes in a natural rather than an acid medium. In addition to lime, unleached wood ashes contain important quantities of potash and phosphates (up to about 5 per cent. of each), the latter being one of the essential foods required by the micro-organisms, and the former by crops.

METHOD OF MAKING COMPOST.

Make a cattle kraal where convenient, and on a firm smooth surface. If veld grass is the chief raw material, make the kraal, or kraals, on the edge of the area to be cut. Make other kraals beside the maize shelling dumps or wheat threshing sites. Put your kraals, in fact, near the source of the chief raw materials so as to avoid slow and expensive carting, by using hay-sweeps and hay-drags to move the wastes up to the kraal.

Size of Kraal. Don't make the kraals too big, otherwise the wastes will not be properly broken up by the feet of the cattle. Ten square yards per full grown beast is the maximum space necessary, and 8 square yards per beast is ample, unless the cattle are wild, of course.

Filling the Kraal. To start with place the wastes in the kraal to a depth of about 1 to 1½ feet in order to soak up the liquid manure. Then, every few days, as the cattle tramp down and soil the bedding (wastes) spread more wastes evenly in the kraal to a depth of a few inches, and repeat the process until the kraal is filled to a depth of 1½ feet with well trampled and soiled bedding. Then clean out the kraals and start again. Four natives working with forks only can clean out a kraal 250 square yards in area in one day. The soiled wastes are made up into heaps as detailed below. Whenever possible use a mixture of two or more different kinds of wastes, since a mixture is more readily broken down.

Adding Soil and Wood Ashes or Lime. From time to time the necessary soil and wood ashes are sprinkled evenly over the bedding in the kraal. The best time to do this is just before putting in more bedding. In this way the soil and ashes become well mixed with the bedding, as is necessary. The quantities of

these materials required is based on 50 square yards of area of the kraal as the unit. For every 50 square yards the following amounts should be added, a *portion at a time.*

Materials.	Rates.
Soil	6 to 12 bags, or 1 to 2 Scotch carts full.*
Wood ashes or Lime (agricultural)	1 to 2 bags or $\frac{1}{3}$ to $\frac{2}{3}$rds bag.
Rock phosphate†	50 lbs.

*A Scotch cart is taken as containing one cubic yard. Since these carts vary somewhat in size this should be checked.

†The addition of rock phosphate is only necessary when all the wastes have a low mineral content as in the case of tall mature veld grass and maize wastes, in which case it assists the decay organisms, since phosphates are an essential food for them.

In order to ensure even mixing of the soil and ashes with the wastes, the latter should be spread in the kraal in 3 or 4 portions of the total quantities given in the table above.

If the waste materials are soft, such as grass, maize husks and wheat straw, the half rate of soil only is needed. If they are hard and woody, such as mature sunn hemp or whole maize stalks, or cotton stalks, use the full rate of soil. If the soil is a sandy type use the half rates of soil, and increase the quantity of wood ashes or lime. In dry districts use the full rate of soil.

Period required to keep Cattle in Kraal. If the farmer wishes to obtain the maximum production of compost per beast the following simple formula will serve to guide him in deciding how long to keep the cattle in the kraal. The constant basis of the formula is 18 inches depth of trampled and soiled wastes in the kraal when the kraal is cleaned out. If the depth of wastes is greater or less than this the cattle must be kept in a longer or shorter time in proportion to the increase or decrease in depth. On present experience, however, it is thought that it will save labour in cleaning out the kraals if the wastes are not allowed to accumulate to a greater depth than 18 or perhaps 24 inches, since it is then possible to do the work with forks only, and the work is easy. If a greater depth is accumulated it may be necessary to employ picks or mattocks in cleaning out the kraal, and the work becomes harder and much more expensive.

The Formula.

$$\frac{\text{Area of kraal (sq. yds.)}}{\text{Number of cattle.}} = \text{Number of days (24 hours each) to keep cattle in kraal.}$$

In other words, divide the area of the kraal in square yards by the number of cattle, and the resulting figure obtained is the number of days (of 24 hours each) it is necessary to keep the

cattle in the kraal. One night can be reckoned as half a day for this purpose. On this basis the farmer can be sure that the wastes receive sufficient dung and liquid manure to ensure their proper rotting, even if all the wastes have a low content of nitrogen. If the farmer has more wastes than the cattle can deal with on this basis, he can reduce the number of days gradually until he finds the lowest limit for the materials he is using.

Making the Heaps and Turning Them. After cleaning out the kraal the wastes are made up into heaps 3 yards wide (4 yards in dry districts), by 4 feet high, by any length which is convenient. Remember to arrange your heaps so that the wagon can get to them easily for carting the ripe compost. After rain has penetrated the top of the heaps to a depth of 6 inches, or after 6 inches of rain, they should be turned with the fork, working from one end or one side, and built up into new heaps. In doing this the whole heap is moved a distance of about 5 feet, or a convenient throw with the fork. In making the first turn take care that the wet materials on top are thoroughly mixed with the dry underneath. *All matted lumps should be shaken out with the fork, and the whole heap left in a loose, airy condition.*

Where the rainfall may fall below 16 inches per annum it is advisable to make the heaps in shallow pits so as to save losses of moisture by the action of drying winds. (See notes under "Winter Kraal Compost.")

Keep one or two iron rods stuck down into each heap to act as rough thermometers. After the first turn these should become so hot, within a day or so, that they cannot be grasped in the hand. The temperature will then tend to fall gradually, and the next turn should be given whilst the heap is still quite warm. It should never be allowed to become cold before the next turn is given.

At the second turn the materials should be found to be covered with a greyish white growth of the fungus which is breaking them down. Heavy rains will cool down the upper portion of a hot heap temporarily, but the temperature will rise again after the rain stops. Usually the compost will be ripe after three or four turns. At each turn see that the dry and unrotted portions of the heap on the outside are placed inside the new heap, to ensure the killing of diseases, pests and weed seeds by the heat.

Keep the tops of the heaps level, and the sides tidy. When ripe the compost should be like well rotted leaf-mould and have the same smell.

Labour Required. It has been found that in making compost on the above system, *excluding the collection and carting of the wastes to the kraal side*, that one native's labour for one day will suffice to make two cubic yards (1 ton roughly) of compost. This means that in one year of 300 working days one native's labour is required for making 600 cubic yards (roughly 300 tons). Therefore four natives in a 300-day year can make more than 2,000 cubic yards of compost.

The labour required for the collection and carting of the wastes to the compost kraal necessarily varies greatly from farm to farm, but is often the heaviest item of expenditure in the making of compost. Wherever possible labour on this item should be economised by siting the kraal as near as possible to the chief source of the wastes. For instance, if veld grass is used on a large scale then place the kraal or kraals on the areas that are being mown, and avoid slow and expensive carting by using hay-sweeps to collect the grass into rough cocks, and hay-drags to draw a number of these cocks together up to the sides of the kraal.

If a silage pit and a stock of good veld hay are placed beside the kraal the working oxen can be employed for making compost in such kraals during the winter. Half an acre of good silage maize with a ration of veld hay in addition (15 lbs. per day) will feed a span of working oxen for a month. It is best to separate one span from another by sub-dividing the kraal, in order to prevent fighting.

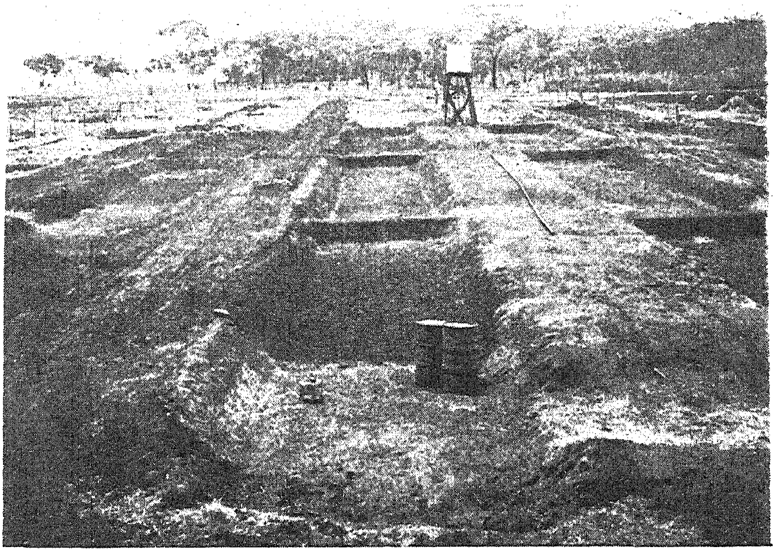
The moderate expenditure in growing the silage and winning the veld hay are well repaid by the increased crop yields resulting from the use of the compost. One span of oxen, *if raw materials are available*, will give a return of sixteen to twenty-four or more tons‡ of compost per month. In one well authenticated case (checked by the writer) a rate of production per span (16) of native oxen was reached of just under thirty-two tons per month. These oxen were rather small in size and average working oxen should give a rather higher rate of production.

On farms in the maize belt it is worth while having a permanent kraal adjacent to the shelling site in which the working oxen can be slept at nights and the maize husks fed to them. The wasted husks, the maize cores and any other easily carted wastes from near by will then form a regular source of cheaply produced compost. The native herd guards can be put on to the job of placing the shelling wastes in the kraal, and a not unimportant advantage gained is that the time normally wasted each morning in gathering the scattered oxen for inspanning is thus saved, and furthermore the oxen get a real rest at nights.

‡Two cubic yards of moist ripe compost are taken as weighing one ton (2,000 lbs.).

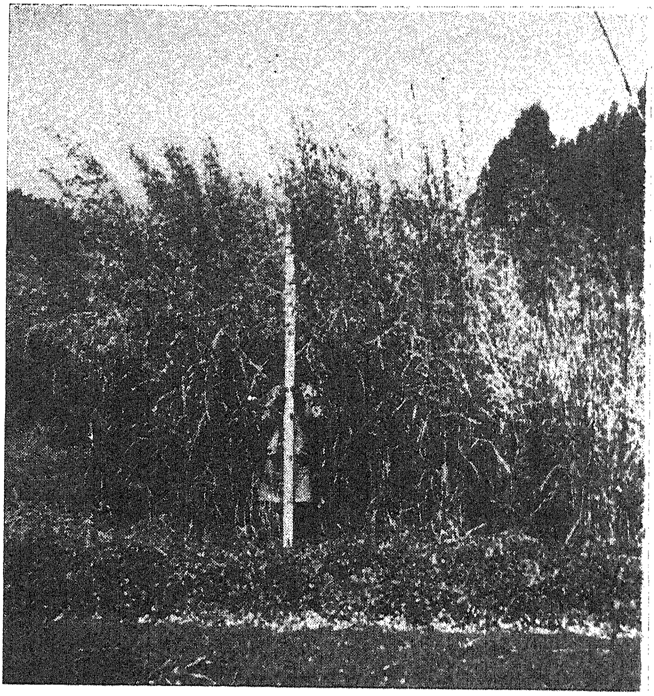
The dairy herd should also be as fully employed as possible in making compost, and this can be done, and with economy of labour, by the simple method outlined below for employing winter kraals combined with perennial compost crops.

Perennial Crops for Composting and Early Grazing. Perennial crops that produce a large bulk of material such as Napier Fodder, Rhodesian Sudan grass, and "Tambookie" grasses are being increasingly grown for the production of compost, and the latest development is the combination of this practice with the use of comfortable winter kraals for the dairy herd. Suitable areas of land next door to the winter kraal are planted to these grasses, and when mature they are reaped and placed in the kraal for bedding and compost production. Expensive carting is thus avoided, as the grasses can be swept up to the side of the kraal by hay-sweeps and hay-drags.



1. The battery of 30 compost pits employed by Mr. E. W. Lamont on the Rhodesia Tobacco Estates, Ltd., for making compost in winter. Note the water tower in the centre with two watering points.

2. View of one of the pits being emptied. Note the sloping walls of the pits and the roads between the rows of pits. Each pit was employed as a cattle kraal.



HYPARRHENIA VARIABILIS. A very promising compost grass which thrives on both sandy and heavy soils. The photograph shows the eighth crop without fertiliser or manure.

In the case of Napier Fodder and Rhodesian Sudan grass these crops also provide very valuable early spring grazing for the cows (on dry land) from September until the veld comes away after the commencement of the rains. Panicum Makarikari is another fairly bulky grass that will also provide this early spring grazing, but it produces less weight of organic matter per acre for composting. Napier Fodder produces the largest weight of material for composting and the best spring grazing, but it must be cut by hand. The other grasses can be cut by mowing machine and thus labour is economised.

Some of the tall "Tambookie" grasses will give heavy yields of compost material for many years on the heavier soils without fertilising, but they do not supply early spring grazing. Some of the best of them (such as *Hyparrhenia variabilis*) seed freely, and are thus easily propagated.

With ample wastes each full grown beast can be made to produce two or three tons, or more, of compost per month in winter kraals where the cattle are kept in all the time except for watering and milking, and the cost of production will be low. The labourers that would normally be herding the stock can be employed for filling the wastes into the kraal, and spreading the soil and wood ash over them.

Rate of Application to Crops. Ten to sixteen cubic yards of compost per acre is a suitable dressing for maize or wheat on sandy soils. On heavy red, chocolate and black soils, dressings of 12 to 20 yards are suitable. From 100 to 200 lbs. per acre of a phosphatic fertiliser should be applied in addition to the compost to obtain the best results. The more compost applied, the more phosphatic fertiliser is required to balance the excess of nitrogen; but phosphatic fertiliser is economised since smaller dressings are required than if compost is not used.

The available evidence indicates that compost should be ploughed under the soil, and not covered by disc-harrow, when it is applied to annual crops. The "one-way-disc" or "disc-tiller" can be used for covering it where it will penetrate the soil satisfactorily. Compost should be covered the same day that it is spread, otherwise considerable losses of nitrogen will take place.

WINTER COMPOST.

Composting can be carried on in winter as well as through the summer, but a cheap water supply is necessary at the composting site.

Some farmers, particularly tobacco growers, prefer to make their compost in winter, and there is this considerable advantage in doing so that the moisture content of the compost heaps can be properly controlled, and therefore can be maintained near the

optimum. The process, therefore, proceeds more smoothly and rapidly than under rainfall, and finished compost can be turned out in three months or even less.

HEAPS OR PITS.

Winter compost can be made either in heaps above ground or in shallow pits two or three feet deep.

Above ground heaps should be sheltered from the prevailing wind if possible, since the latter causes loss of moisture and a substantial fall in temperature on the windward side of the heaps. For these reasons also the heaps should run across the direction of the prevailing wind so that they shelter each other.

It is also advisable to build the heaps in pairs with a small space of three or four feet between them, so that after the second or third turn when their height has been much reduced the two heaps can be thrown into one. The larger combined heap will hold the moisture and heat longer and will thus mature better, and water will be economised.

PITS.

Where the site for composting, for reasons of economy of transport or otherwise, must be placed in a high exposed situation, or where the water supply is limited, shallow pits should be employed, since they shelter the heaps from the wind, and so reduce evaporation of the moisture. These may be two or three feet deep, not deeper, since aeration will then be unduly interfered with, decay will be slowed down, and loss of nitrogen by denitrification at the bottom of the heaps will be encouraged. A convenient width for the pits is fifteen feet, and a convenient length is 45 to 65 feet. The sides and ends of the pits should be given a slope of 45 degrees, since this ensures that as the heaps settle down no open space is left in which flies can breed owing to the lower temperature. For the same reasons the sides and ends of the heaps do not unduly dry out. The pits need not be dug down the full depth required, since the spoil from the pits can be used to raise the ground level around the pits.

The battery of pits should be arranged on a rectangular plan, with roadways wide enough for a wagon to pass with ease down between the parallel lines of pits as shown in the accompanying illustration of a well designed battery laid down by Mr. E. W. Lamont in 1939 on the property of the Rhodesia Tobacco Estates, Limited. It will be seen that a thousand gallon water tank has been mounted on posts about 10 feet above the ground in the centre, and from this pipes are run to two watering points, one on either side. From these points a hose enables all the pits to be watered with an adjustable spray nozzle. The tank can be kept filled by two natives working a double-action hand pump.

Ample pressure is developed with this arrangement to give an effective spray at the nozzle. The rectangular design allows of expansion of the battery as required. The pits were 16 feet wide, by 2 feet deep, by 66 feet long, and each pit held approximately 30 tons of finished compost. Therefore at one filling the whole battery of pits yielded roughly 900 tons of compost.

WATER SUPPLY.

In the first stage of the process when the fungi are chiefly concerned in the decomposition, and thorough aeration of the heap is particularly necessary, the percentage of total moisture in the heap should be below 50 per cent., ranging between 40 and 50 per cent. If too much moisture is present at this stage aeration of the heap is interfered with, the fermentation is checked, and the high temperature (between 140° to 150° F.) which is so dsirable for killing weed seeds, flies, pests and diseases, is not developed.

The most common fault observed in the making of winter compost is the use of excessive quantities of water. The materials in the heap should be kept just moist; "as moist as a squeezed sponge." Some simple water supply, such as that described above, which will give the small pressure necessary to produce a spray is strongly advised, since a spray is very desirable to ensure even and proper watering of the heaps. The carting of water and spreading by hand, or the use of sumps with distribution of the water by hand, are uneconomical of water and labour. Where an irrigation furrow is available, water can be distributed from this over the adjacent pits by the use of small movable channels of sheet iron to guide it to different parts of the pit.

Howard and Ward found at Indore, in a dry climate, where the pits were sited on a wind-swept plateau, that from 200 to 300 gallons of water were required (according to season) in the making of one cubic yard (roughly half a ton) of finished compost. These figures will assist the farmer in designing his water supply.

FILLING THE PITS.

In order to avoid trampling by the labour on the heap, and so packing it and excluding air, the pits should be charged in sections 5 to 6 feet wide commencing at the end.

A layer of the soiled wastes from the kraal, about 6 inches deep is laid down across the pit to a width of 5 to 6 feet, and this is sprinkled with water so that the materials are just moist, but not soaked. Then successive 6 inch layers are placed on top, each being watered, until the section is built up to a height of 18 inches to 2 feet above ground level.

This procedure is continued until the end of the pit is reached, where an empty space of 5 to 6 feet wide is left to allow the heap to be turned. Fermentation should commence immediately, and within 24 hours a high temperature should be developed in the heap. Thereafter the handling of the heap should follow the lines laid down above for summer compost.

At each turning of the heap only sufficient water should be sprinkled over the wastes as they are being turned to maintain them in the condition of moistness of a squeezed sponge. The surface of the heaps may receive a light sprinkling of water from time to time as it dries out.

If the whole pit (save the empty space for turning) is filled in one operation, and not by sections, then trampling by the labour is inevitable, and the heap must receive its first turn immediately after filling the pit. Thus, filling the pit in sections saves one turn of the heap.

In order to assist aeration of the heap it is worth while to make vertical air vents in each section of the heap as it is completed. Three vents may be made across each section, evenly spaced, by means of a crowbar or wooden stake thrust down into the heap and worked with a circular motion to leave an open hole.

ALTERNATIVE METHOD OF FILLING PITS.

The following valuable modification was first introduced by Mr. E. W. Lamont, and can be strongly recommended, since it greatly economises labour.

Instead of first putting the wastes under cattle in separate kraals, each pit is temporarily used as a cattle kraal, by erecting a moveable fence of native posts and two or three strands of wire, close around the edge of the pit. The wastes are then placed under cattle in the pit as described above for summer kraal compost, and the pits allowed to fill up to ground level, when the fence is moved intact to the next pit.

Then a space is cleared at one end of the pit to allow of turning. The heap is then turned, and the wastes watered as they are being turned. This system economises time and labour, since the preliminary treatment of the wastes in separate kraals is avoided.

DUNG SLURRY.

The use of dung slurry when building the heaps or filling the pits, or at the first turn of a heap or pit, will go far to ensure a quick start to the process, and the even decomposition throughout the heap which is to be aimed at.

Dung slurry is a thin mixture of fresh moist dung stirred up with water. The addition to the slurry of a little wood ashes, and a little material covered with the white fungous growth from another active heap, can also be made with advantage.

The slurry should be lightly and evenly sprinkled over the wastes.

Heaps which do not heat up properly after the first turn may well be treated with dung slurry whilst turning them again.

SANDWICH COMPOST.

As the name indicates, this method of making compost consists in building up the heaps in layers of the various materials in sandwich fashion.

The heaps should be of the same dimensions as given under the kraal compost system.

First lay down a layer of the crop wastes, grass, etc., 9 inches in depth. Over this sprinkle the soil, and wood ashes or lime in the quantities given in the table below. Then spread a layer of dung or manure to a depth of one inch. In this case, by "dung" is meant the animal droppings with no bedding included. If a mixture of dung and bedding as it comes from the cow byre is used then a depth of at least 3 inches should be used. Use too much rather than too little to start with, and then cut down gradually until the minimum is found, if it is necessary to economise.

Sheep, pig and poultry manure or dung contains more nitrogen than does cattle dung, and the above quantities can be reduced by about two-thirds in the case of poultry manure, and by about a half in the case of sheep or pig manure.

Then spread other layers of wastes, soil and ash, and dung in the same order, repeating the process until the heap reaches the required height of 3 to 4 feet.

Sandwich compost seldom rots as readily as kraal compost because the mixing of the various materials is not so thorough. A thin sprinkling of dung slurry over each layer of wastes will help to remedy this. If the heaps do not heat up well after the first turn, slurry can be applied whilst turning the heaps again.

Where the majority of the wastes are veld grass and maize wastes that have a low phosphate content, rotting will be assisted by sprinkling a little rock phosphate over each layer, especially if agricultural lime is used to replace wood ashes.

Quantities of Materials.

Materials.	Total quantity required per 9 yards length of a standard heap.
Soil	1 to 2 Scotch cart loads or 12 to 6 grain bagfulls.
Wood ashes or	1 to 2 grain bagfulls
Agricultural lime	$\frac{1}{3}$ to $\frac{2}{3}$ grain bagfulls.
Rock phosphate	50 pounds.

The above quantities are the *total* quantities required for a 9 yards length of heap and therefore, if there are 4 or 5 layers then one quarter or one-fifth of these quantities of soil, ash, etc., must be spread over each layer.

Turning the Heaps. With sandwich compost more care is needed at the first turn in order to obtain thorough mixing together of all the added materials with the wastes.

When sandwich compost is made in the winter with an artificial water supply, each layer can be watered after it has been spread, and then the first turn can be given to the heap as soon as it is completed.

Refer back to the kraal compost section for information concerning turning the heaps and testing the temperature inside them with iron rods.

Crushing Hard Materials. Whole maize stalks, sunflower stalks and cotton stems require crushing before sandwich composting them in order to enable the micro-organisms to attack them easily; otherwise the rotting of the heaps will be unduly delayed, and much labour wasted on extra turns of the heaps.

This can best be done on the farm by spreading them on farm roads where wheeled traffic will pass over them and break them up.

Growing Legumes on the Heaps. Where the wastes are all of low nitrogen content and supplies of dung are insufficient, extra nitrogen can be supplied by growing suitable legumes on the tops of the heaps before the first turn is given, in the way ingeniously devised by *Jackson, Wad and Panse.

In this Colony sunn hemp is the most suitable legume to use in summer, but our other field legumes can also be used, such as cowpeas, or kaffir beans, and Somerset velvet beans (other velvet beans are too slow in growth).

About two or three pounds of sunn hemp seed is sown over each 100 square yards of surface of the heaps. The surface of the heap can then be covered with a thin layer of top soil to ensure good inoculation of the sunn hemp.

The sunn hemp may grow to a height of only about 6 to 12 inches before the first turn of the heap is due (after 6 inches of rain), but the roots penetrate well down through the heap and the root nodules collect much atmospheric nitrogen.

For winter compost legumes such as tares or vetches, and lupins can be utilised, but the seed will require inoculation.

Special Precautions for Dry Areas. Where, as in parts of Matabeleland, the annual rainfall may be less than the minimum required to ensure the complete breakdown of summer compost the following measures can be employed to economise the moisture supply.

Use shallow pits of 2 to not more than 3 feet in depth, in which the heaps are sheltered from the wind, wherever this is feasible. Alternatively to using pits, but less effectively, the heaps may first be made 18 feet wide by 2 feet deep, and then after two or three inches of rain have fallen, rebuilt into heaps 9 feet wide to 4 to 5 feet high. This ensures a more rapid start of the decay processes, and a more economical use of the early rains. As soon as decay of the materials has commenced, the heaps more readily absorb and retain subsequent rains.

Again in making up the heaps use the full rate of soil laid down in the tables, or even fifty per cent. more, since this assists the retention of moisture in the heaps. Use ant heap soil, or the heaviest soil available, since they are more retentive of moisture.

The dimensions of above ground heaps, too, may be rather greater than for normal conditions, and they may be made 12 feet wide by 4 feet to 5 feet high. If heaps must be made above

*"The Supply of Humus to Soils," by F. K. Jackson, Y. D. Wad and and V. G. Panse.

ground (always use pits if possible) then make them up in pairs separated only by a few feet so that as they decrease in height as rotting proceeds each pair can be thrown together to make a larger heap which will naturally retain moisture better and suffer less drying by wind.

The use of dung slurry will also assist materially in economising moisture, since it assists in assuring a more rapid start of the decay processes.

Where the dung and urine of stock need not be economised, then greater quantities of dung can be used, or the cattle can be kept in the compost kraals for a longer period than normally would be the case. This extra supply of added nitrogen in the dung and urine will speed up the decay of the wastes and in that way economise the rainfall.

Again the use of full rates of wood ashes or agricultural lime will tend to make conditions more suitable for the decay organisms and thereby speed their work and so assist the best use of the available moisture.

Thorn Bush Encroachment in Relation to the Management of Veld Grazing.

By OLIVER WEST, D.Sc., Pasture Research Officer.

A contribution from the Central Veld and Pasture Station for Matabeleland.

1. INTRODUCTION.

The menace of Thorn bush encroachment, especially in the more arid parts of the Colony, is now so obvious that there are very few people who are not fully alive to the existence of this problem; yet because of a general lack of understanding of the ecological problems involved in the utilisation of veld by grazing animals, the situation is rapidly being aggravated. Many areas which are remembered by the older generation as open grassland are now dense bush and practically everywhere the density of the bush is increasing rapidly to the detriment of the grazing. The amount of grass available for the grazing animal is being reduced at such an alarming rate that there is ample justification for the statement that **there can be no future for the cattle industry in these parts unless the invading thorn can be controlled.**

(Although very little work has been carried out in the scientific comparison of the value of thicket as opposed to cleared grassland grazing, it should be noted that Staples (3) while at Mpwapwa, Tanganyika Territory, showed quite conclusively that pastures in which the bush was cleared increased greatly in their carrying capacity, and that grass pastures when properly managed provided adequate protection against erosion, whereas secondary bushland pastures, although more lightly stocked, exhibited much more bare ground towards the end of the season.)

In the "Mixed Veld" and "Sweet Veld" areas of the Colony the principal invading species, which form thickets replacing grassland are *Thorn Trees*, the majority of which belong to the genus Acacia, and although it is with the Thorns and the problems presented by their invasion of grassland in Southern Rhodesia that this paper is concerned, a very brief summary of what is known about the genus *Acacia* in general may prove useful in orientating the particular aspect with which we are concerned.

The genus *Acacia* belongs to the family *Leguminosae*, in which there are slightly less than 700 different species. They are widely distributed throughout the tropics and sub-tropics of

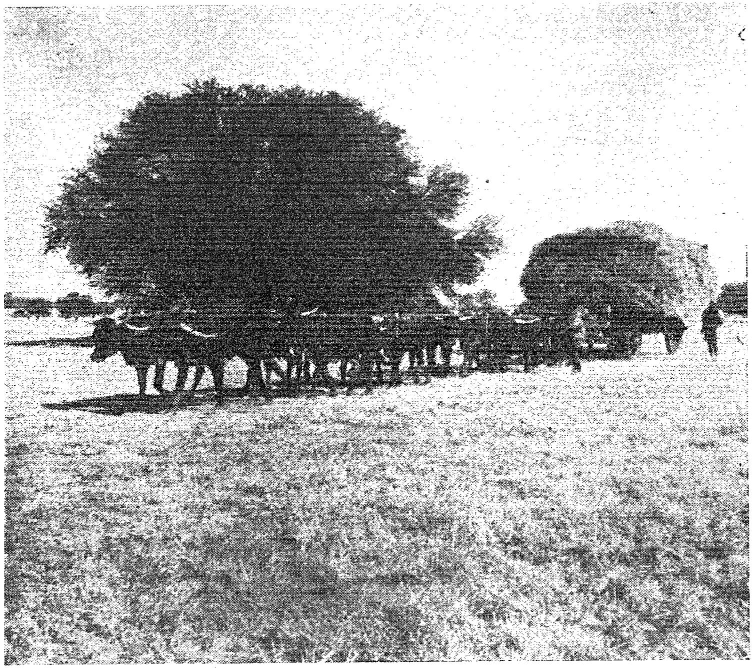


Fig. 1.—The ideal. A cleared pasture with scattered shade trees and an excellent grass cover. The tree behind the span of oxen is a fine specimen of the Sweet Thorn, *A. karroo*.

Fig. 2.—A magnificent *Acacia albida* growing on the bank of the Gwaai River, Gwaai Native Reserve. *Acacia albida* is the largest of our native Acacia trees. It bears heavy crops of nutritious pods.

Fig. 3.—The Bush encroachment problem. A dense tall thicket of Sweet Thorn, *Acacia karroo*, on the Rhodes Matopo Estate. This thicket has been protected from grazing.

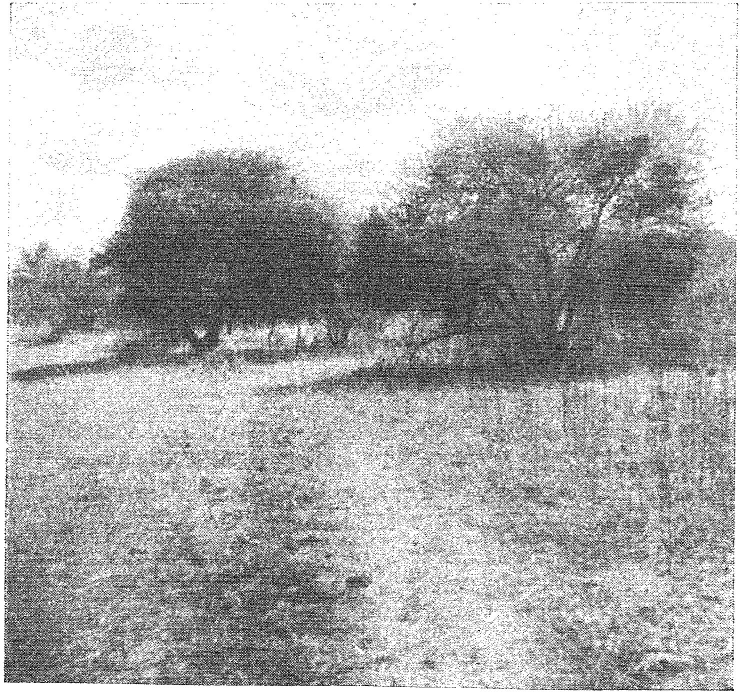


Fig. 4.—*Acacia litikunensis* in the lowveld, Matobo District. Although it bears crops of nutritious pods, *A. litikunensis* tends to form dense thickets and should be kept under very careful control.

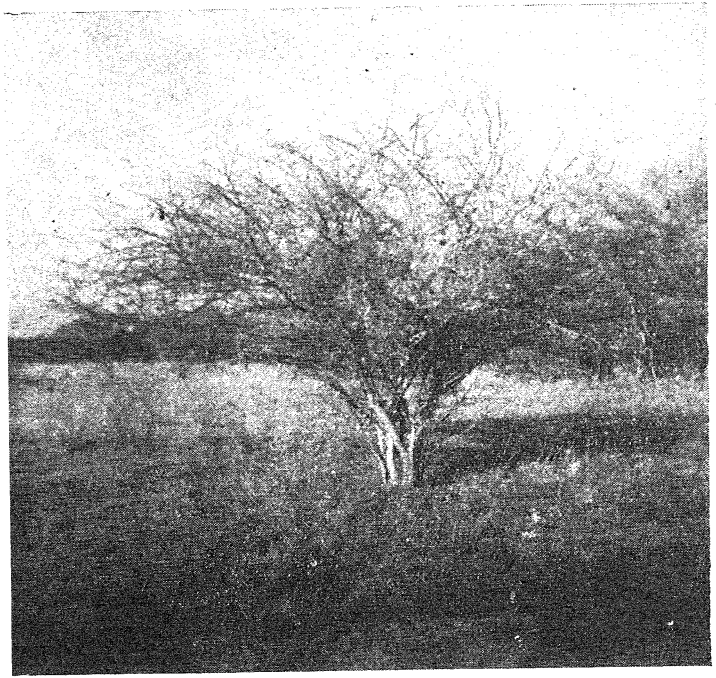


Fig. 5.—*Dichrostachys glomerata* invading grassland at Two Tree Kop. This shrub bears heavy crops of nutritious pods but tends to form dense, impenetrable thickets and is most difficult to eradicate. A dense thicket of *Acacia arabica*, *A. gerrardii* and *Dichrostachys nutans* fills the background.

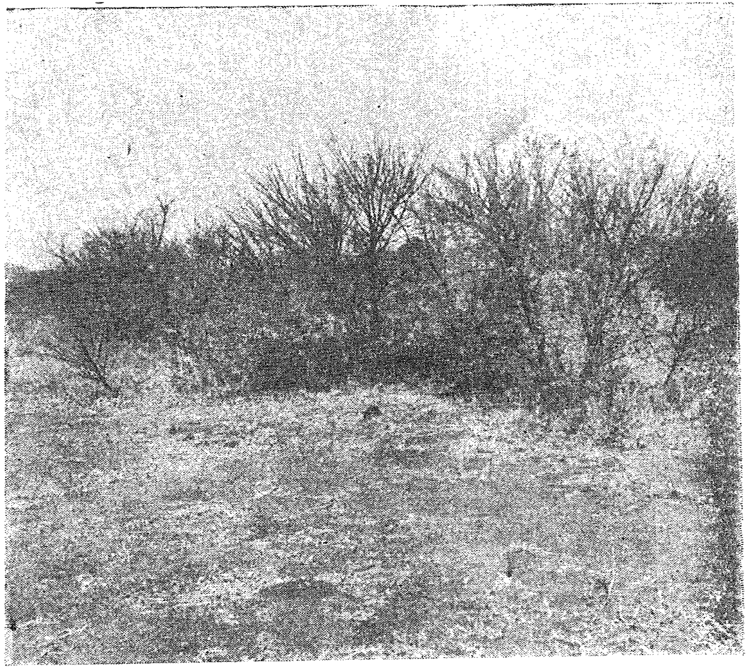


Fig. 6.—The Bush encroachment problem. A dense thicket of young Sweet Thorn, *Acacia karroo*, on the Rhodes Matopo Estate. This thicket is grazed; note the bare ground and incipient erosion.

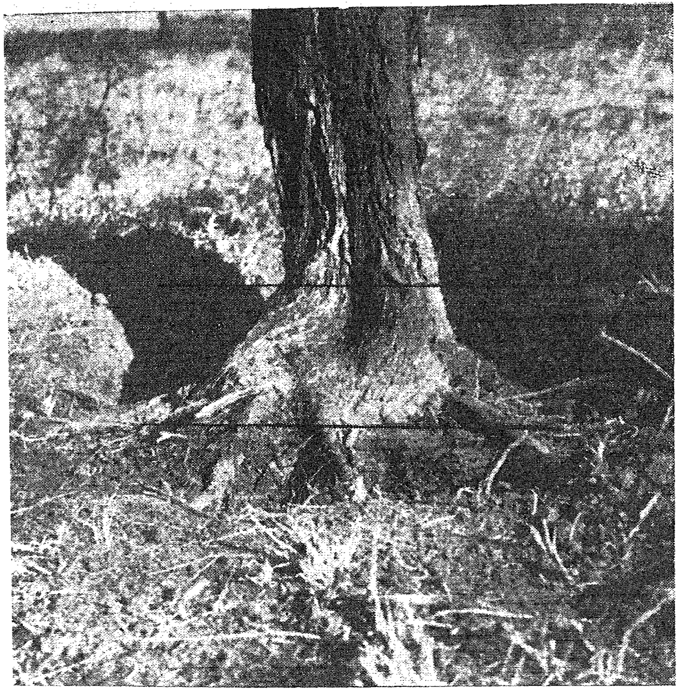


Fig. 7.—*Acacia arabica* stem prepared for the paraffin treatment. The belt which should be painted with paraffin is indicated.

Fig. 8.—This plate illustrates the method used in applying arsenite of soda. The tree is *Acacia arabica*.

the new and old worlds, but are chiefly found in Australia and in Africa. They are usually trees or shrubs, sometimes climbers and very rarely herbs.

The African species are almost invariably thorny or spiny and have finely divided pinnate or bipinnate leaves. Most of the Australian species, which are commonly termed *Wattles* to distinguish them from the African *Thorn Trees*, are unarmed and substitute phyllodes (flattened petioles) for leaves.

Many of the exotic Acacias are of considerable economic importance. Catechu is obtained from the East Indian *Acacia catechu* and *Acacia suma*. The gums and bark of some of the Acacias are used in medicine, while bark from the Black Wattle, *A. mollissima*, is one of the most important sources of tannin. Wattle bark is an important crop in parts of the Union and Kenya. Its production is being developed in the Eastern Districts of this Colony at the present time. *Acacia cyclopis*, the Port Jackson Willow, is most useful for fixing coastal drift sands, while useful and attractive timber is yielded by other species. Many species are ornamental and are widely used in landscape gardening.

In Africa the native species are absent from the South Western districts of the Cape, but are very important throughout the rest of the Continent.

Phillips states that there are thirty-eight species in South Africa. Twenty-six are recorded from Southern Rhodesia, of which two are climbers, three small shrubs, fifteen small or medium trees and six are large trees.

One of the Rhodesian species, *A. macrothyrsa*, is usually entirely spineless. It resembles somewhat the Rhodesian Wattle, *Peltophorum africanum*, which is not an Acacia.

Other trees likely to be confused with the Acacias are various Albizzia spp. and the spiny Chinese Lantern Tree, *Dichrostachys glomerata*.

The characteristic, often flat-topped silhouette of many of native Acacia species lends a charm peculiarly African to the Bushveld scenery. Some species grow into truly majestic trees reaching heights of 80 feet or thereabouts with a correspondingly great spread of branches.

These handsome trees form a very valuable part of our native flora. They are confined to special habitats and seldom play any part in the bush encroachment problem. Some of them, e.g., *A. galpini*, yield valuable timber and because of this are in danger of elimination.

In a country as devoid of large trees as is most of Matabeleland, it is saddening to see truly magnificent specimens cut down for the pounds-shillings-and-pence value of their timber, and it is time some effective means of ensuring the protection of healthy, vigorous specimens of the less common species was devised.

It is the smaller native species of Acacia as well as the closely related *Dichrostachys glomerata* that constitute the principal menace, and of these some of the species most

commonly responsible for thicket formation and bush encroachment are:—

(a) *Acacia arabica* (or *benthami*). "The Lekkerruik Peul" is a small often flat topped tree. It is rough barked and bears valuable crops of black beaded pods, which fall to the ground and are much relished by stock. In many parts this species tends to form dense and extensive thickets and thus despite the value of its crop of pods it must be regarded as a potential danger and should be kept under very careful control.

(b) *Acacia heteracantha* (or *litikunensis*) "The Haak en Steek," is so called because it bears both straight thorns and curved prickles. Its spirally coiled pods fall to the ground when dry and are eaten by stock. The remarks made about *A. arabica* apply equally to this species.

(c) *Acacia erubescens* is a small tree which bears short, recurved prickles and a spikate not globular, white or pinkish white inflorescence.

(d) *Acacia davyii* is a small shrubby tree, bearing long straight thorns and a globose yellow inflorescence. It forms very dense low growing thickets.

(e) *Acacia karroo*, "The Sweet Thorn," is specially important on the black soils. It is probably the worst of the thicket formers. When well grown it is a handsome tree with black bark, straight white thorns and characteristically drooping branches. The young trees are difficult to kill and coppice readily.

(f) *Acacia chariessa* is the most important and widespread of the shrub species. It is a low growing shrub with slender branches bearing recurved scattered prickles.

(g) *Acacia gerrardii*, "The Red Bark" or "Wol Doorn," is a small, often flat topped tree with yellowish red bark. The young branches and thorns are densely covered with grey, downy hairs. The mature thorns are long, straight and white.

(h) *Dichrostachys glomerata*, The Sickle Thorn or Chinese Lantern Tree (is not an Acacia, but is closely related, belonging to the same family Leguminosae). The Genus Dichrostachys is a small one consisting of about 11 species found in Africa, Asia and Australia. The species *Dichrostachys glomerata* is a large shrub or small tree with twisted branches and stout, often sickle shaped thorns. Its inflorescence which earns the shrub one of its common names, is shaped like a Chinese Lantern or tassel, yellow above and purple below. It bears large bunches of twisted brown pods much relished by cattle and game. Where it flourishes it forms dense and impenetrable thickets and as it, unlike the Acacias, is capable of suckering from the roots, it is most difficult to get rid of. Stumping trees established from seeds usually leads to a dense thicket of shrubs arising from root suckers.

2. THE ECOLOGY OF THE INVASION OF GRASSLAND BY TREES.

The occupation of any area by plants always proceeds by stages, each stage preparing the way for the succeeding stage which first invades and eventually replaces it, to be in turn

invaded and displaced by a later stage in the succession of stages or steps known as the *Plant Succession.*

The succession terminates in the final stage, which is known as the *Climax Vegetation.* The Climax is controlled by the climate and is permanent, remaining the same as long as the same type of climate prevails. In this Colony there is nowhere any area where the climate is such that the climax vegetation should be grass. All of our grassland is seral, i.e., the natural tendency of the succession is towards bush and forest of various types. Thus all open grassland is grassland because of some factor or set of factors which has prevented or is retarding its invasion by bush.

The most important retarding factor is fire. For ages African vegetation has been subjected to periodical fires which have served to maintain grassland or open woodland in place of the denser bush which almost invariably results when fire is kept out. It is important to realise that the invasion of grassland by trees and shrubs is a natural process and that our native thicket forming species are pioneer trees and shrubs specially fitted to invade grassland to prepare the way for the longer lived trees which will eventually replace them.

Let us consider this process of invasion. Imagine an area of open grassland to which Acacia seeds have been brought, in the droppings of animals, by wind or water or any other agency. The grassland soil is almost completely filled with grass roots, so that when the Acacia seed germinates, there is in a normal season intense competition for what water is available. Many of the seedlings perish. Those which survive continue to compete fiercely until by growth they so entrench themselves that the grass competition is eliminated and the Acacia assumes dominance.

In view of this competition it is not surprising that treatments which tend to encourage the grass discourage the thorn and vice versa.

This is the reason for the dense uniform stands of thorn often found on areas of abandoned cultivation and for the rapid increase of thorn on veld which is weakened by over-grazing or bared by trampling.

3. THE PRINCIPLES OF VELD GRAZING MANAGEMENT IN RELATION TO THE PREVENTION OF BUSH ENCROACHMENT.

In the management of mixed veld grazing where the palatibility of the numerous constituent species varies considerably and where both palatibility and feeding value decrease rapidly as the grass matures, it is not possible to obtain full utilisation of the veld by means of the grazing animals. *Burning or mowing* is necessary to even up the pasture and to offset the effects of selective grazing. Attempts to obtain the same effect by increasing the grazing pressure until the veld is grazed down completely, invariably have a very bad effect on both the grazing animal and on the veld, causing a rapid slowing down in growth and loss of condition in the animals and leading to symptoms of severe over-grazing, the replacement of the more desirable

perennial grasses by less desirable pioneer types and ultimately to denudation followed by severe erosion. Thus burning or mowing is essential not only for the control of bush encroachment but also for the maintenance of a grazable sward.

Mowing is obviously the least wasteful form of veld control and there is much that can be said in its favour, but often for various reasons topography, terrain, large size of farms, presence of tree growth, etc., it is impossible to mow and fire has to be resorted to. In general it can be said that mowing is suited to small semi-intensive propositions while burning has to be used in large scale operations.

It is often wrongly maintained that burning is always harmful. Indiscriminate burning, burning at the wrong time and, bad management after burning undoubtedy do great harm, but in many veld types burning at the proper time followed by a sufficient rest is a sound practice and a very efficient method of discouraging bush and shrub. (Ref. Staples 4.)

The correct time for burning is determined by the following considerations:—

(a) The grasses should be dormant so that a good fire can be obtained without damage to the living parts of the grass plants. In Spring the first growth of perennial grasses is obtained at the expense of food reserves stored up in their roots. If this first growth is consumed by fire, the plants have to draw on an already depleted store of reserves in order to produce fresh shoots. Thus a late burn seriously weakens and may kill many of the very plants it is desired to encourage. Grassland which has shot its bolt by utilising most of its stored up reserves in producing shoots and is then burned, is very slow in coming away the second time.

(b) The burned veld should remain bare for the shortest possible time. If the burn is made too early, the ground is bared and until it is covered again by fresh growth, the tender crown of the dormant plants are subjected to injury by frost and insolation. The surface soil from which the protecting top hamper has been removed becomes pulverised and is blown away by the wind. When the rains come, excessive run-off ensues because the insolation and wind erosion has caused the bared top soil to become very impermeable and so the damage which began when the soil was bared is very much aggravated by the reduced efficiency of the rainfall and by sheet erosion.

It is evident that considerable nicety of judgment is called for in deciding the proper time to burn. The aim is to burn just before the grass begins to grow but while it is still dormant. Experiments have shown that the best results are obtained when the burn is made *immediately* after the first good rain at the end of the dry season and before new growth has started. After burning it is essential to rest the area burned until the grass has grown sufficiently to keep slightly ahead of the grazing animals put on to it.

If burning is to be of any use for controlling bush encroachment, it is essential to have a good fire. This means that areas to be burned must be rested, or only lightly grazed, during the growing season preceding the burn to provide sufficient grass to burn. As periodical rests during the growing season are essential

for the welfare of the pasture in order to enable the grasses to build up their root reserves and to set seed, this growing season rest, necessary for ensuring a good burn fulfils two very important requirements of sound grazing management.

The essentials of a sound grazing system for the proper management of mixed veld where the probability of bush encroachment has to be taken into consideration can be summarised as follows:—

(a) The rate of stocking must be slightly below the capacity of the veld grazed.

(b) Periodical burning or mowing, and if necessary, weeding must be employed to keep the pasture grazeable and to combat the invading thorn trees.

(c) Provision must be made for a periodical rest during the growing season to enable the grasses to restore their depleted root reserves and to set seed. If burning forms part of the system, this rest should precede the burn.

(d) After a burn resting is essential.

These essentials can only be provided for when a deferred rotational system of grazing management is employed.

The necessity for before-burn rests in grazing systems which incorporate burning means that veld which could have been grazed by cattle has perforce to be kept for burning. Thus the incorporation of burning in a grazing system entails the sacrifice of some of the stock carrying capacity of the area managed. The extent to which the stocking capacity is lowered depends on the area burned each year or, expressing the same idea in a different way, on the frequency of the burns.

In a deferred rotation a burn every three years means that one-third of the total area is burned each year, but where the burn takes place every six years only one-sixth of the total area is burned each year. The frequency of burns needed to prevent bush encroachment is dependent on very many local factors such as the climate, the vegetation type and the particular stage in the plant succession under consideration. It is a very complex problem and is being investigated in a series of deferred rotational grazing management trials at the Central Veld and Pasture Station for Matabeleland. In the light of our present knowledge it is safe to say that where bush encroachment exists, it may be advantageous to burn as frequently as once in three years in order to establish a fairly stable type of open parkland as expeditiously as possible, but that when this aim is achieved and the land stocked correctly, it should be possible to maintain the desired veld type by burning not oftener than once in five or six years.

4. THE ERADICATION OF EXISTING THORN SCRUB AND BUSH.

While sound veld management is regarded as the first essential for the control and prevention of bush encroachment it cannot be expected to cure areas that are already heavily bushed. These areas must first be cleared and then by proper management kept

In clearing areas for grazing the aim should be to reduce dense bush or scrub to open parkland where the trees are widely scattered in grass. The area should not be cleared completely because scattered trees in grazing land are very valuable, serving not only to beautify the landscape, but to supply shade for the grazing animals and by breaking the force of the wind and slowing down the movement of air over the surface of the ground to retard evaporation and to conserve water. They may also by supplying crops of pods considerably augment the available food supply. Particularly valuable in this connection are *Acacia albida*, *Acacia woodii*, *Acacia giraffae*, *Acacia litakunensis*, *Acacia arabica*, *Dichrostachys glomerata* and *Bauhinia thonningii*, all of which bear heavy crops of pods with a high feeding value.

There is a wide choice of methods of clearing. Mechanical methods involving the use of expensive machinery and suitable for large scale operations are being extensively tested in other countries. The most promising of these methods comprise the use of:—

(1) Bulldozers, or bulldozers plus attachments designed to prevent the large scale disturbance ordinary bulldozing operations involve.

(2) Power winches.

(3) Power operated saws mounted on light tractors used in combination with poisons applied to the cut stumps.

(4) The Evona Giant disc harrow.

It is hoped that the proposed experimental bush clearing unit will shortly test the efficiency of these machines under local conditions. Until large scale clearing trials have been made very little can be said about the efficiency and costs of machine clearing. On the other hand, a considerable amount of progress has already been made in the investigation of manual methods suitable for clearing operations conducted on a smaller scale.

The following recommendations are based on work carried out at the Central Veld and Pasture Station for Matabeleland, as well as on results obtained in the Union of South Africa and in the United States of America. (Fisher 1 and Parker 2.)

It is necessary to emphasise that the investigation is still in a preliminary stage and that the conclusions reached may be modified by results obtained subsequent to the publication of this paper.

(i.) **Clearing and Stumping.** For dealing with ordinary bush where there is a good proportion of medium sized trees, the cost of clearing and stumping an area is often more than paid for by the cordage sold as firewood. If it is decided to attack the problem in this way, the primary object of the clearing operation must be clearly borne in mind. The primary object is the conversion of dense bush to valuable parkland grazing. The firewood should be regarded as a by-product, the sale of which is used to defray the cost of the clearing, the main object of the operation.

As clearing is the main object, the trees should not be cut off and left to produce by coppice growth a much less useful type of bush than formerly existed, but should be carefully stumped

of the root and stem. The majority of trees if cut off in this manner die and give no further trouble, but if any stem or bark is left attached to the taproot, coppicing will occur.

(ii.) **The Use of Paraffin.** Illuminating and power paraffin as well as Dieseline, etc., can be successfully used in killing thorn trees, but though the use of these oils presents certain definite advantages over the more dangerous poisons such as arsenic, they are expensive, and unless very carefully used, unreliable.

In their favour it can be said that they are easily obtained, do not require mixing, are non-poisonous to man or stock and they are comparatively pleasant to use. In the most successful method of application as developed at the Estcourt Pasture Research Station in Natal, soil is dug away from the base of the stem until the taproot is exposed and then the paraffin is applied liberally, preferably by means of a paint brush to the region where the root joins the stem. The painting of a belt about nine to twelve inches wide completely surrounding this part of the tree is sufficient. It is important to use sufficient paraffin and painting should be continued until the work ceases to absorb the oil and begins to show a wet outside surface.

The quantity of oil used varies considerably with the size and type of tree. When dealing with fairly well grown single stemmed trees, a quart of oil is usually sufficient to treat from 10 to 12 trees. Results from preliminary trials indicate that the treatment is most effective when the soil is dry.

Good results have also been obtained by pouring the oil around the base of each tree without any preliminary excavation, but this method is very wasteful as from 1½ to 2 quarts per tree are required to obtain a good percentage of killed trees. Paraffin penetrates dry sandy soils best. Wet clay soils are practically impermeable. Because of this the efficiency of paraffin as a killing agent, particularly when it is poured into the soil around the stem, is very much greater if it is used when the soil is dry, and it is most effective on trees growing in light sandy soils.

(iii.) **The Use of Arsenic.** Arsenite of Soda and Arsenic Pentoxide are both very effective killing agents. In contrast with paraffin their disadvantages are obvious. They are highly poisonous substances and are extremely dangerous if handled carelessly. With proper care, however, their use is quite safe, efficient and cheap.

The Preparation of Arsenical Solutions.

Arsenite of Soda is sold in 50 lb. drums for the purpose of mixing cattle dips. An effective tree killing solution costing three shillings and one-tenth of a penny per gallon, can be obtained by dissolving 5 lbs. of the crystalline substance in one gallon of water. Any of the proprietary arsenical cattle dips may be used in place of this solution if they are diluted to the same

is to be used for tree killing 3 gallons of water should be added to the contents of one drum which will give 8 gallons of tree poison costing 3s. 5¼d. per gallon. Both of these solutions contain approximately 4 lbs. of white arsenic to the gallon, which is the most effective killing strength. One gallon of the solution is sufficient to treat about 100 to 120 trees.

Arsenic pentoxide is soluable in water and a solution of 2 lbs. to one gallon of water is a very effective killing strength. Unfortunately at present only chemically pure arsenic pentoxide at the high price of 4s. 9d. per lb. is obtainable, which means that a gallon of the tree killing solution costs 9s. 6d.

It should be possible, however, to land a commercial arsenic pentoxide much more cheaply if there was sufficient demand for it as a plant poison.

Application of the Arsenical Solution. Field trials have shown that the most effective method of applying the solutions described above is as follows:—

The tree should be cut down as close to ground level as possible. The stump is then slashed vertically once or twice. The arsenical solution is poured on to the cut stump, which is covered with brushwood and left. A large enamelled tea pot or kettle provides a very convenient container, but if this is not obtainable the use of a large pressure oil can enables the poison to be applied in an efficient and economical manner.

It is important to apply the poison to the cut surface of the stump as soon as possible after cutting. The poisonous solution should be used carefully. Apply enough to each stump to wet thoroughly the cut surface, especially the inner edge of the bark, but do not splash it about or spill it on the ground.

Unless cattle and other livestock can be excluded from the areas where the poisoning is being carried out, great care must be exercised in covering poisoned stumps and soil on which poison has been spilled. The area can be grazed quite safely while poisoning is in progress if the livestock are prevented from reaching soil or plant surface to which the poison has been applied. It is advisable, however, to keep stock away from treated areas until a good rain has fallen.

The Use of the Brushwood for the Prevention of Erosion. An important feature of the method advocated is that the trees are felled as close to ground level as possible. This renders it possible to make use of the heavier timber for firewood, while the brush wood and smaller trees can be used to encourage revegetation and to prevent erosion. Heavily bushed areas are often devoid of ground cover and for this reason are very vulnerable to damage by erosion when the bush is cleared. To prevent this the brush should be packed in rows along the contour and all bare patches should be covered with brushwood. Revegetation proceeds very rapidly under the protection afforded by the brush covering and sufficient cover to effectively prevent erosion is quickly established.

Precautions to be Observed while working with Arsenical Solutions.—Arsenical compounds and solutions in addition to being extremely poisonous when taken internally are powerful skin irritants.

Persons handling any of these substances should be protected against bodily contact and from inhaling dust or vapours arising from them. Gauntlets and goggles should always be worn by workers handling the solutions.

Arsenical solutions spilt on to the skin or clothing may cause ulcers if the affected parts are not immediately washed with soap and water. Persons suffering from skin irritations should discontinue handling arsenic and should receive medical attention.

All containers and equipment, stocks of arsenic, etc., should be clearly and conspicuously marked with red paint, and when not in use be kept out of reach of children and natives under lock and key.

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Bulletin for Cotton Growers.

By G. S. CAMERON, Chairman, Cotton Research and Industry Board.

Much has happened since the last Bulletin on Cotton was issued in July, 1942, and it may be advisable to take stock of the position both from the growing and from the manufacturing aspects of the industry. Taking the former, the growing of cotton, there is much to record, although the progress may not appear to be as spectacular as what has been achieved in the industrial sphere. Acreages and yields, on the whole, have increased, but they have not kept pace with the Spinning Mill's requirements of raw cotton. This may be a matter of disappointment to some, yet the reason, chiefly economic, is not far to seek. For many years the price of cotton on the world markets has been low in comparison to other primary products, and the law of supply and demand operated adversely against increased production of the crop. When Rhodesian prices were raised from 6d. to 9d. per lb. for top grade lint, there was an immediate response, and the acreages trebled in one season. The price advantage, however, was largely offset by a greater advance in the price of maize. Cotton was further raised to the shilling per lb. level, but by this time maize had been raised to fifteen shillings per bag, plus two shillings where a definite proportion of green manuring had been practised.

Subsequently the price of maize has been advanced to 20s., and then to 25s. per bag, a price with which cotton cannot keep pace.

The Spinning Mills have taken in Rhodesian cotton and paid 25 per cent. to 30 per cent. more for it than for better cotton from surrounding territories. While there is a world shortage of food crops, it would be unwise to undertake propaganda on behalf of cotton, especially when the latter is freely available from neighbouring countries. For the time being, therefore, and perhaps for several years to come, it may be necessary to import the bulk of Southern Rhodesia's cotton supplies from Nyasaland, Uganda and possibly the Belgian Congo. Much will depend on the world price of raw cotton, and that is not at present predictable. It is worth noting, however, that owing to dislocation of the textile industries during the war period, there is a world shortage of cotton piece goods, and it is likely to be a long time before the disorganised mills and factories can fill up the void created during the long period of low production, and war wastage.

Everything points to a boom phase looming ahead in the textile industry, and although it may be some distance off, it is bound to come. This is one reason why it is imperative that the cotton growing industry in Southern Rhodesia should be maintained, if only on a reduced scale. It is not the only reason, however, as it has been made abundantly clear at Gatooma, and other parts of the country, that cotton is a highly desirable crop in a well balanced

rotation scheme, leading to sound farming practice. This is specially the case when it is possible to make reasonable quantities of compost, and apply it to the cotton. The rotation system practised at Gatooma on the Cotton Station, on fairly good land, has been in vogue for the best part of 20 years, and there appears to be no visible signs of soil deterioration. On the contrary, there has been a steady improvement in maize yields, and to-day the land is in better heart than ever. The rotation system is as follows:—

Maize.
Sunn hemp ploughed in.
Maize.
Cotton. (Farm-made compost applied at the rate of 5 tons per acre.)
Maize.

On poorish soils, such as light sandy loams and sand veld, it is suggested that it would be better to take only one maize crop following cotton.

The best maize crops are usually reaped in the shift following composted cotton. In order to utilise fully the maize stover and any other available farm produce, it is usual to feed 40 to 50 steers in the dry season between end May and early October. In this way 300 to 400 tons of compost are produced annually, sufficient to give a dressing of five tons per acre to the cotton. In Southern Rhodesia cotton does not respond to artificial fertilisers, but to compost there is an immediate response. The maize following cotton gets the residual benefit of the compost in addition to the rotational benefit of the cotton. As previously stated, it is the maize in this shift which gives the heaviest yields. It will be noticed that the introduction of cotton in the above rotation obviates the necessity of growing and ploughing in more than one green crop. It must be emphasised that cotton does not dispense entirely with the necessity of a green manure crop. The latter must be grown at least once in five years, on an average farm, in order to return to the soil the organic matter which has been taken from it by continuous cropping. Cotton is not a soil robber, and if the cotton seed is fed to steers in making compost, and through it returned to the soil, it is left in better condition for any succeeding crop. Its physical condition will have been improved, and the farmer gets the benefit of having grown a cash crop. The importance of cotton in the rotation is becoming better recognised, especially in years of low and scanty rainfall. This may account for its increasing popularity in Matabeleland, where, ordinarily, maize growing is a chancy business.

One sometimes hears it stated that cotton seems to prefer a year of drought. Strictly speaking, this is not correct, as cotton does best in a year of well balanced rainfall. But it can withstand a drought better than the majority of economic crops. In Southern Rhodesia it has been necessary to breed a hardy, vigorous type of cotton that will stand up to any kind of season—drought, alternating with flood periods. This has been achieved at the Cotton Station, Gatooma, after long years of patient plant-breeding work extending over a period of 20 years.

This may seem a long time, but actually it is not so when one considers that no known variety of cotton proved sufficiently adaptable to be taken straight into cultivation. Many varieties were tried, from all the established cotton growing countries in the world, but none were sufficiently suitable to be put into cultivation.

The cotton now grown throughout the Colony has had to be built up gradually by straight line breeding, based on the well known U.4. strain selected by Parnell at Barberton in 1925. This selection was from a very mixed stock of Uganda cotton, and its progeny split into many types, large and small, early and late, long, short and medium staples, as well as many other differing characters. One of the characters essential for Southern African conditions was a plant with fairly hairy leaves, as it was known that smooth-leaved plants succumbed to jassids. These are small leaf-sucking insects which not only feed on the cell sap of the cotton plants, but in doing so introduce some kind of toxin which kills off the cotton plant before it reaches maturity. Now, jassids were a well known cotton pest in India, where it was known that if the plant had hairy leaves it escaped damage from jassid attack. Hairs on the under surface of the leaf impede the movements of the young jassid nymphs, which are unable to fly. Also, they are unable to travel any distance in a straight line, but move over the under surface of the leaf with a zig-zag motion. They prefer the under surface of the leaf because it shades them from direct sunlight, which they appear to avoid as much as possible. The cotton leaf hairs also make it difficult for the adult female to lay her eggs. Whenever she tries to do so, the hairs seem to get in her way or irritate her. Similarly with the newly-hatched nymphs. As soon as it emerges from the egg-shell it gets entangled in dense undergrowth of hairs, and is sometimes strangled at birth. The writer is sometimes asked to explain why "Improved Bancroft," a smooth-leaved cotton, gave such good results in 1924, the year which precipitated the cotton boom over 20 years ago. The answer is only theory, but it seems to meet the case. Prior to 1924, cotton had not been grown extensively in Southern Rhodesia, and never sufficient of it in any one place to attract jassids from the veld. Now, whenever man begins to plant large acreages of crops he is, all unwittingly, upsetting the balance of nature. Where under natural conditions there may occur one wild cotton plant for every 10, 20, or 100 *square miles* (the exact density of wild cotton plants is not known), but immediately cotton becomes a cultivated crop the whole situation is altered, and we find 10,000 *plants per acre and more.* The attractive force of such dense concentration of plants to the jassids, scattered throughout the surrounding countryside, can be well understood. Now in 1924 it probably took the naturally occurring jassids some time to discover this newly arranged food supply, kindly provided by man, and concentrated in dense patches all over the country. Once they made the discovery, however, they quickly bred up and multiplied. Many crops were left to stand over to the following season and these acted as natural insectaries for jassids, boll-worms and other cotton pests to multiply and carry over to the following season. Put in another way, they acted as a reservoir of insects ready to bombard the succeeding crop.

What has been said about jassids in this connection applies equally to other cotton pests, such as stainers and boll-worms. The

point is stressed because there are to be found a number of farmers who do not comprehend why a close season for cotton is enforced from the 1st of October each season until the arrival of the first planting rains. It is an attempt to starve out the "carry over" of insects from one season to the next. A kind of "scorched earth policy." How far it has been successful is difficult to estimate, but the policy has definitely reduced the amount of stainer-damaged cotton, which was on the increase, prior to the introduction of an enforced close season.

RATOONING OF COTTON AND/OR ALLOWING IT TO STAND OVER IN THE FIELD FROM ONE SEASON TO ANOTHER IS PROHIBITED.

It is necessary, by law, to have the cotton plants uprooted by a date specified in the "Government Gazette." This date, which may be altered from year to year, is usually fixed for the first day in October. Should a cotton grower not uproot his cotton plants by the date specified, he becomes a menace, not only to himself and his immediate neighbours, but to the whole district for miles around.

It is the farmer's own interest to clear up his old cotton lands earlier than the above specified date. By ploughing and discing he disturbs and helps to break up the tough earthen cocoons which protect the over-wintering pupae of Sudan boll-worms. This pest is becoming a greater menace to cotton than formerly was realised, and its increase can only be checked by adopting the above measures.

The following notes are based partly on experience gained on the Cotton Breeding Station, Gatooma, and partly as a result of talks and discussions with experienced cotton growers in various parts of the country. What is learned from the experience of others is often as useful—sometimes more so—than what is learned on one place situated in one part of the country.

The question as to whether a farmer should grow cotton is one which he must answer for himself. It is felt that many more farmers ought to be growing cotton than are doing so, but it is difficult to overcome prejudice against a crop which did not come up to the extravagant expectations that once were held about it.

Those who have been growing cotton regularly over a period of years know by experience that the crop to-day is a payable one. As a rotation crop its benefit is most noticeable, especially with maize. There is also the value of the cotton seed for fattening cattle and the grazing value of the cotton plants after the crop has been harvested.

Cotton as a Rotation Crop. Farmers have remarked on the distinct increase in maize yields following cotton, and this has been very marked on the Cotton Station at Gatooma. It is worth mentioning that the increase in maize yields following cotton has been noted in the majority of maize-producing districts as well as in Matabeleland and Northern Rhodesia. Just why cotton should be such a good rotation crop is still a matter for speculation. There are a number of good reasons put forward, mostly quite sound, but no definite claim can be made for any of them until

fully investigated, and that is likely to take some time yet. Perhaps the beneficial effects are not due to any one particular factor, but to a combination of several. For the time being it is sufficient to know that the benefit does exist, and academic investigations as to the why and wherefore must wait.

Cotton as a Trap Crop for Eelworm. Of very great importance to tobacco growers is the fact that a crop of cotton has a marked effect in reducing the nematode population in the soil. The results of experiments carried out at Trelawney Tobacco Research Station indicate quite definitely that eelworm infestation of tobacco is much reduced when tobacco follows cotton in rotation.

The following is an extract from a report by B. L. Mitchell, formerly Entomologist on the Tobacco Research Station, Trelawney:—

> "It is believed possible that this intolerance of the cotton rootlets to eelworm galling may be the key to the reason why the infestation of tobacco following cotton is so much reduced. The rootlets may act as a trap crop, becoming infected with eelworm but being shed from the plant before the nematode has time to reproduce. If this is the case, then the eelworm population would be absorbed and destroyed."

A full account of these experiments is given in the Reports of the Tobacco Research Station, Trelawney, 1943, 1944 and 1945.

Choice of Land. Cotton is very tolerant in the matter of soil, but it cannot grow properly where there is any tendency for soil to become waterlogged. Put in another way, COTTON CANNOT STAND WET FEET. It is very necessary to stress this fact in block letters, because it is a point which new growers fail to appreciate until it is too late—and then they blame cotton. Even poor land, provided it is well drained, will produce a cotton crop, but this is not to say that cotton prefers poor land—it does not. On the other hand, it is not economic to put it on very rich soil which would give a better financial return under other crops. A number of maize growers have made a practice of planting cotton on land which has ceased to be sufficiently productive for maize. By this means they are enabled to get another maize crop off the land before putting it under green manure. This is merely an expedient, as it is not claimed for cotton that it takes the place of a green crop ploughed in. It is better to plant cotton before land has become too worn out, and add a dressing of farm compost, say five tons to the acre. Not only will this ensure a good cotton crop, provided it was planted early, but it is also a sure method of obtaining at least two good maize crops following the composted cotton.

Preparation of Soil.—As cotton requires to be planted early, it is necessary to have the land well prepared to ensure a good seedbed. If the land is disc harrowed immediately after ploughing in the autumn, it should be possible to dry plant the cotton if planting rains threaten to be late. It is necessary here to utter a word of caution against planting "too" early. Supposing planting rains arrive early in October, as sometimes happens, it would be risky to plant cotton then, as the seed would germinate, but there is always the risk of a drought after early rains, and the young seedlings might die off.

As a rule it is better to wait until the first or second week in November.

It is as well to explain here that the necessity for early planting is not on account of falling temperatures in the autumn, but in order to get early flowering. The earlier the flowering, the less damage there is likely to be from bollworms. In some ways "bollworms" is a misnomer. The American bollworm is the same pest as the "corn earworm" in maize, or the tomato worm, or the worm that does so much damage to citrus. In the case of cotton, the greatest amount of bollworm damage is done during the bud and flowering period. If it is remembered that every cotton bud is a potential flower and every cotton flower is a potential boll, then we realise the necessity for getting the greatest number of flowers produced and fertilised before bollworm attack reaches its maximum.

Planting. There are two outstanding points in connection with the planting of cotton: (1) DO NOT PLANT TOO DEEP, and (2) USE PLENTY OF SEED. The first point is stressed because it sometimes happens that, after the seed has been planted, there may be a heavy tropical downpour of rain, which batters the surface of the soil, and this dries into a hard crust if the rain is followed by a spell of hot, dry weather. This happens more frequently than is generally recognised, and it is on this account that shallow planting is strongly recommended. If planted too deep, the seed may germinate, but the young seedlings will not be able to push their way to the surface and break the crust which has formed. For the same reason it is necessary to use plenty of seed. The seed rate generally recommended is 25 to 30 lbs. per acre for machine-delinted, fuzzy seed, and about 12 to 15 lbs. for acid-delinted seed.

Depth Regulators. To ensure uniform depth of planting, the use of depth regulators is recommended. They consist of iron shoes which are fixed as shown in the accompanying photograph. In addition to preventing the planter from going too deep, the effect of the shoe passing over the soil tends to make a smooth track in which the cotton seed is dropped. These depth regulators are available, and may be had on payment by applying to the Cotton Ginnery, Gatooma.

The tracks made by the depth regulator shoes will scour out in the wet weather if they run across the contour of the land instead of parallel with it. This warning may sound very elementary to experienced farmers, but the fact remains that it is necessary to mention it.

Machine Planting. Where a planter is equipped with the orthodox cotton seed attachment, it is advisable to plant the fuzzy seed, as such attachments are too wasteful of acid-delinted seed.

Where, however, the planter has no cotton seed attachment, only acid-delinted seed can be machine-planted. The planter is set up as for maize planting, but the smallest holed maize plates obtained should be used, or preferably a small bean plate. As less seed is required per acre, the higher cost of acid-delinted seed is more or less cancelled out. The planter should be set so that the rows are 36 ins. to 42 ins. apart.

Hand Planting. Four or five seeds per hole should be dropped at 6 to 9 ins. apart in the row and very lightly covered over with loose soil. As is the case with machine planting, the rows should be 36 to 42 ins. apart.

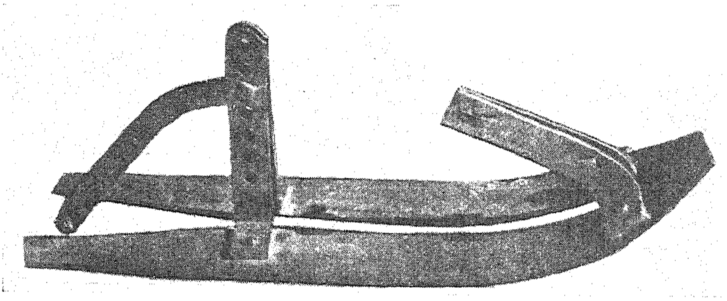
Acid-Delinted Cotton Seed. In recent years there has been a steadily increasing demand for acid-delinted seed for planting. This is a most encouraging feature, and one to be fostered.

Although acid-delinted cotton seed costs a little more than twice as much as machine delinted seed, its advantages far outweigh the extra cost. It goes twice as far in the matter of seed rate and has a high percentage of seed soundness, generally over 90 per cent., as against 60 per cent. or even less in the case of machine-delinted seed. Its germinating capacity is higher, every seed is fully developed, and contains a large size heavy kernel which, on germination, gives rise to a strong, healthy seedling. The delinting of cotton seed with concentrated sulphuric acid is an operation which the farmer could undertake for himself, but he is strongly recommended not to do so. It is a messy job, and one in which there is always the risk of someone being severely burned through careless handling of the concentrated sulphuric acid. At the Ginnery the cotton seed is first machine-delinted, then treated with concentrated sulphuric acid, which is allowed to drain off. The seed is then thoroughly washed to get rid of surplus acid. Seeds which are broken, punctured or in any way damaged are dissolved in the acid, and only those with healthy seed coats remain intact, because they are covered by a waxy substance resistant to the action of the acid. Light or immature seeds rise to the surface during the washing process and are floated off. These are kept to one side and sold as cattle feed. Only the "water sinkers" are retained for seed for planting.

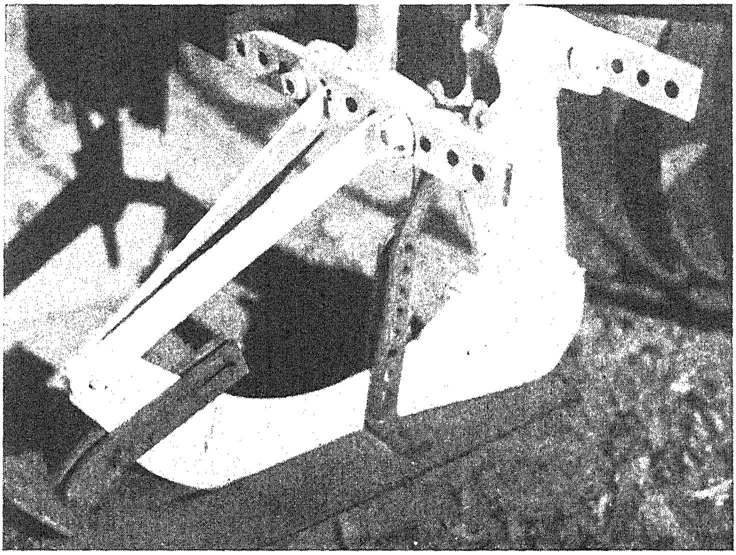
Thinning Out or Singling. If planting has been properly carried out, and provided the weather conditions have been favourable, the young seedlings should begin to appear above ground after four to six days. By the tenth day the young plants should be distinctly visible in clearly defined rows. When the young plants are 4 to 6 ins. high, they should be thinned out (singled) to approximately one plant at intervals of 9 ins. apart. If the land is dirty with weeds, it would be advisable to put the cultivators through before thinning.

Cultivation and Weeding. The number of cultivations required will depend upon the cleanliness of the land or otherwise. Some farmers find it possible to thin out and hand-weed at the same time. Others maintain that this is not possible, and prefer to make two operations of what should be carried out in one. It seems to depend upon the labour and, to a greater extent, how it is supervised.

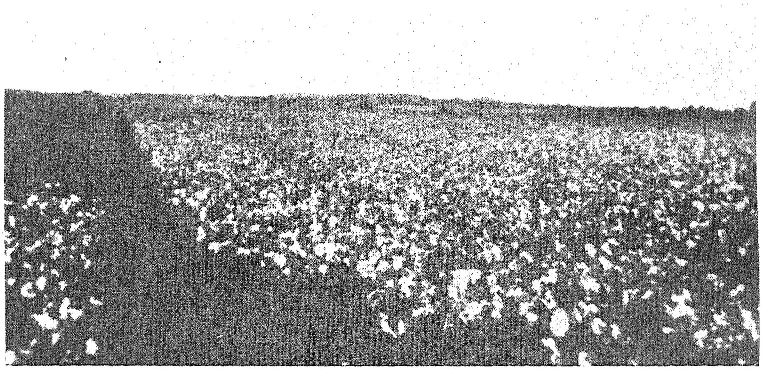
The number of subsequent cultivations depends, as already stated, on the cleanliness of the land. One hand cultivation and two or three cultivations with the cultivator ought to be sufficient, normally, but it should be remembered that cotton offers an opportunity of getting land thoroughly cleaned. Care should be taken that the cultivators are not set too wide. It is the early cultivation that counts, and if cotton is kept clean from the start, there should be less need for subsequent cultivations.



One of a pair of depth regulators for cotton planting machine.



Method of attaching depth regulator to planter.



Cotton Station, Gatooma, 1947: Showing stunted plant growth owing to drought conditions. Average yield approximately 600 lbs. seed cotton per acre.

Early Growth. In the early stages cotton does not grow quickly, and this should be noted by farmers who grow the crop for the first time. At the beginning of the season the young plants are getting their roots well down into the soil, and it is not until they have done so that they begin to grow vigorously above ground.

Fertilisers. The use of artificial fertilisers on cotton is not recommended. In Southern Rhodesia the surface application of artificial fertilisers to cotton produces no response, even when heavy dressings are applied. It is thought—and it may well be—that cotton, being a deep-rooted plant, gets the residual benefit of fertilisers applied to previous crops. If a farmer wants maize to follow his cotton crop, then he could apply raw rock phosphate to the cotton, but it is the subsequent maize crop and not the cotton which would derive the benefit.

Compost. Although cotton does not respond to artificial fertilisers, it reacts immediately to applications of farm-made compost. Various dressing have been applied to find out which is most economic. So far it would appear that applications in the neighbourhood of five tons of compost per acre are the most economically effective. Composted cotton gets away much quicker at the beginning of the season and the benefit of the compost is most marked in a year of long, protracted drought. Compost has a definite effect in increasing the yield of seed cotton per acre. All this has been very clearly demonstrated on the Cotton Breeding Station at Gatooma. So much so, that the fattening of steers as chillers is an established part of the farming operations in order to get a sufficient supply of dung and urine to convert the farm waste material into compost. The compost is spread on the land and ploughed in. A comprehensive set of trials carried out on the Cotton Station proved that it is better to plough in the compost than to harrow it in.

Bulletins giving instructions for the manufacture of compost are obtainable from the Department of Agriculture, in Salisbury, and short notes are to be found in the "Rhodesian Diary and Businessman's Calendar."

Harvesting. When the first cotton bolls begin to open towards the end of April or beginning of May, according to whether the crop was planted early or not, it is then advisable to look into the crop and see whether it is likely to be a heavy one. One can judge this by the number of full-grown but unopened bolls on the plants. If the plant is carrying well formed bolls up to the top, the chances are that the crop will be a heavy one and may necessitate two pickings. If there was a heavy bollworm attack when the top flowers were forming, there is not likely to be much of a top crop. When this happens, it is well to make one picking only and wait for all bolls on the plant to open. If it is an early season, this may take place about the end of May or the beginning of June. In 1942 the cotton on the Gatooma Station was ready for picking in April, but it was such an exceptionally early season that it cannot be considered normal.

Native labour in Southern Rhodesia does not seem to adapt itself readily to cotton picking, but much depends on the condition of the crop, together with the amount of supervision.

With natives who have not had previous experience in picking cotton it is well to let them practice for two or three days, under supervision, before setting their daily task. If the crop has grown tall and rank, picking is more difficult and allowance should be made accordingly. Short, heavy bearing plants which have shed most of their foliage are the easiest to pick, and under such circumstances the task can be increased.

The most straightforward and best way to find out whether the cotton is ready for reaping, and, at the same time, discover the daily task to be set, is to try one's own hand at picking. To do an hour's picking of cotton and then weigh up the results can be both helpful and illuminating—and sometimes humiliating !

Another point worth mentioning is that cotton picking can start at sunrise if need be, whether there is a heavy dew on the cotton or not. Quite a number of farmers got hold of the notion that cotton must not be picked until well on in the forenoon. Where the latter idea originated from is not known, nor does it matter, because it is quite wrong as far as Southern Rhodesia is concerned. As much attention as possible should be paid to clean picking, as the cleaner the cotton, the higher the grade, and consequently the price. From this point of view it is well to instruct the pickers to start off with only picking the fully opened and matured bolls. This should give a very clean cotton. Subsequently the rest of the cotton can be picked. Admittedly this procedure is only practicable with a fairly heavy crop, which requires two pickings. Much as clean picking is desired, it may not prove economical to go too far in insisting on clean picking, as the increased cost of picking due to smaller task may exceed the premium obtained for the better grade.

The number of pounds of seed cotton picked per man per day on the Cotton Station at Gatooma (1942) is given in the following tables by categories. Farmers with good cotton crops should do better than this, as cotton picking is not always a straightforward operation on the Cotton Station. Daily pickings are reduced by the fact that small plots, progeny rows, etc., have to be harvested separately.

SUMMARY OF COTTON PICKINGS.

Cotton Station, Gatooma.

Expressed as percentage of Native Labour able to pick categorical amounts of seed cotton per man per day.

(Average of first and second pickings.)

2%	of the labour	picked	between	30 and 35	lbs.
2%	,,	,,	,,	35 and 40	,,
9%	,,	,,	,,	40 and 45	,,
18%	,,	,,	,,	45 and 50	,,
24%	,,	,,	,,	50 and 55	,,
38%	,,	,,	,,	55 and 60	,,
6%	,,	,,	,,	60 and 65	,,
1%	,,	,,	over	65	,,

The average yield of seed cotton per acre was 650 lbs.

The crop opened earlier than usual and was over-ripe before it was possible to arrange for the harvesting. This meant that the cotton was easier to pick, as it came away freely from the

capsules, and there was very little "pulling" to be done. One should not expect such easy picking in, say, a year of late autumn rains.

Mechanical Harvesting. At one time it was considered that native African labour was both plentiful and cheap, but that state of affairs, if it ever existed, no longer applies. Many farmers state that they would be willing to grow quite extensive acreages of cotton if they could only harvest it. Similar conditions are being experienced in certain parts of the cotton belt in the United States of America, and large growers have been compelled to resort to the use of mechanical cotton pickers. These have reached a stage where their use is stated to be more economical than hand labour, although they do not pick the cotton as clean. Seed cotton harvested by such means is said to be about two grades lower than when picked by hand. Recent visitors to the Cotton Station have remarked on the apparent suitability of Rhodesian-grown cotton to mechanical harvesting, and there appears to be considerable argument in favour of the idea. Our seasons are short, and in the autumn, when the top soil is drying out, the cotton plants drop their leaves more readily than in countries where longer seasons are experienced. The Cotton Research and Industry Board has on order a complete cotton-picking unit from the United States, but difficulty is being experienced in obtaining same. When, eventually, it does arrive, it will be given a thorough try-out in the Gatooma area, and if found to be suitable, arrangements will be made to import a sufficient number of units to serve other districts if the acreages planted to cotton justify doing so.

Ginning Fee. The one-time ginning fee of 1d. per lb. LINT, plus commission charge of 3%, has been abolished, and all seed cotton delivered at the Ginnery, for purchase by the Cotton Research and Industry Board, is ginned free of charge.

Payment for Crop. Soon after receipt and examination of the seed cotton the guaranteed price is paid to growers on the weight and class. There are four classes according to grade and colour. The prices guaranteed by the Government are usually advertised widely in the Press each year well in advance of the planting season.

Full particulars can be obtained on application to the Cotton Research and Industry Board.

Packing of Cotton. Seed cotton is generally packed into woolpacks for despatch to the Ginnery, from which woolpacks are obtainable on hire. As fresh supplies are now difficult to obtain, the woolpacks should be handled with care. The cotton may be packed tightly without detriment, and the ideal weight is 450 lbs. of seed cotton per woolpack. When the woolpacks are being filled, it is usual to hitch the four corners of the open end to upright poles set in the ground. This keeps the woolpack open, and permits a boy to trample the seed cotton into the pack, especially when the bottom half is being filled. Before harvesting commences, a form is sent to all growers, which, when completed, advises the Ginnery as to the approximate yield, and an order to despatch a certain number of woolpacks on hire.

Marking of Woolpacks. Growers who have their own woolpacks should stencil their names or initials on the top flap of each woolpack.

Growers who obtain woolpacks on hire from the Ginnery will be supplied with "tags," pieces of cloth with their initials stencilled on, which tags are to be sewn securely to the top flap of the woolpacks, which will be sufficient for correct identification of the packs on arrival at the Ginnery.

Delivery of Cotton. Cotton may be despatched to the Ginnery as soon as ready and convenient. Railage is for grower's account, but cotton may be consigned railage forward. Growers are supplied with forms on which to advise despatch of seed cotton and give instructions regarding method of payment desired.

Seed Supply. All enquiries for cotton seed, whether for planting or for cattle feed, should be addressed to the Manager, Cotton Ginnery, P.O. Box 124, Gatooma.

It is advisable to order one's seed requirements as early as possible. All cotton seed for planting issued by the Cotton Research and Industry Board is tested for soundness, and every precaution is taken to ensure that only the best seed is sent out. For this reason it is always advisable to buy your seed from the Ginnery direct, and not through any other source. **On no account should cotton seed that has been bought for cattle feed be used for planting.** Cases are known where this has been done with disastrous results to the crop and the grower's finances. It cannot be too strongly emphasised that the use of cheap seed leads to crop failure.

Conclusion. For those who contemplate cotton growing, the following points are worth repeating:—

(1) Prepare land in plenty of time, and secure a good, even tilth.

(2) Order your seed well in advance.

(3) Plant shallow and as early as possible within reason—say, in November.

(4) Use plenty of seed.

(5) Early thinning and cleaning are both essential.

(6) When in doubt, do not hesitate to write and ask for guidance.

Tobacco Culture in Southern Rhodesia.

By D. D. BROWN, Chief Tobacco Officer.

[This replaces Bulletin 1278 now out of print.—Ed.]

SEED-BEDS.

The seed-beds are the foundation of the crop and consequently the greatest care should be exercised in the selection of a suitable site and in the preparation and management of the seed-beds. One of the prime essentials in producing a good crop of tobacco of any type is to have a plentiful supply of well-grown, healthy plants ready when required for transplanting. Lack of suitable seedlings at the proper time may cause great inconvenience, and in some cases may result in the failure of the crop.

Selection of Site. Careful consideration should be given to the selection of a suitable site for the seed-beds. The area selected should, if possible, be well sheltered from the prevailing winds, for seed-beds placed in an exposed position not only require more watering, but the young plants do not thrive as they should. It is essential that the site should be near a permanent and uncontaminated water supply. Large trees should not be too near the seed-beds, as their roots would deprive the plants of food and moisture, and might interfere with the growth of the seedlings by casting too much shade.

A site having a good exposure to the sun is preferable, as this will influence the growth of the seedlings. The beds should be arranged so that the young plants may have the maximum amount of sunlight, the early morning sunlight being especially beneficial. An eastern or north-eastern exposure is best.

In order to ensure the fullest supervision, the tobacco seed-beds should be as near as possible to the homestead. The proximity to the homestead will necessarily be governed by such considerations as suitability of soil, water supply and shelter. If possible, the beds should also be reasonably close to the fields. It may be necessary to erect an artificial windbreak constructed with long grass, reeds or maize stalks laced to a couple of strands of wire strained to posts surrounding the seed-bed site.

The area selected should not be on a steep slope. When it is not possible to have a fairly level site, the beds may be arranged in terraces on slightly sloping ground. In the latter case it will be necessary to dig a drain above the site in order to prevent any rush of water during rain storms. The seed-beds should also not be too close to the banks of rivers liable to become flooded during the rains, otherwise irreparable loss of seedlings might result.

Soil. The most suitable soils for seed-beds are sandy loams and alluvial soils which have a plentiful supply of humus and are naturally well drained, friable and fertile. It may not always be possible to find an ideal type of soil on a suitable seed-bed site, and when this is the case much can be done to improve the texture of the soil so that it may be used for seed-beds. Should the soil be too light and friable, a few wagon loads of heavier soil or antheap can be spread over the surface of the site and thoroughly mixed with the soil. On the other hand, if the land is too heavy and stiff, a similar application of sand will improve the texture and render such soils more suitable for raising tobacco seedlings. Care must be taken not to apply nematode-infested soil to the seed-bed site.

The beds for the early sowing may be situated on the margin of a vlei, provided the soil is not too cold, but such locations should be avoided for later sowings, as during the rains vlei soils become water-logged. On many farms the soil near the only available water supply is liable to be too wet. In such cases the only alternative is to provide adequate drainage. Neither time nor money should be spared on this work, as the season's supply of seedlings may depend on the proper construction and effectiveness of the drains. Speaking generally, open drains of sufficient width and depth to drain the site thoroughly should be cut around the four sides and, in addition, a channel must be cut from the lowest corner to lead away all drainage water. In order to prevent the sides of the drain from caving in, they should be made to slope inwards so that the top of the drain is wider than the bottom. The correct angle at which to cut the sides of the drains is determined according to the nature of the soil. Under average conditions, however, the slope of the sides should be about one to one, and not less than a half to one. For example, a drain having a depth of four feet and a bed width of two feet would have a surface width of ten feet on the basis of one to one, and a surface width of six feet on the basis of a half to one. Where artificial shelters are to be erected around the beds, space should be left for them between the trenches and the seed-bed area.

Negligence in the matter of drainage may be the cause of failure in the production of tobacco seedlings. This applies more particularly to Turkish tobacco seed-beds because they are sown later in the season when the rainfall is heavy. As Turkish type tobacco seedlings are grown during the wettest period of the year, the seed-beds should not be made in vleis which become water-logged during the rains.

An area should not be used for seed-beds more frequently than once in every four or five years. When the same site is used annually, the seedlings are more liable to the attacks of insects and plant diseases. The soil is also rendered less suitable through the heavy applications of water and the annual sterilizing. New land is preferable for tobacco seed-beds, as weeds and grass are less troublesome and the seedlings are not so much subject to the attacks of insect pests and plant diseases. Old vegetable garden sites should not be used for tobacco seed-beds because of the danger from eel-worm infestation. Suitable crop rotation is essential in the proper management of an established site for

seed-beds. The selected site should be sub-divided into four areas of equal size and separated by roadways about 15 feet in width. In any year only one of the sub-divisions should be used for tobacco seed-beds. This means that tobacco seedlings will be raised on each plot in rotation every fifth season. During the intervening years some suitable crop such as Giant Rhodes grass *(Chloris gayana)* should be grown for the purpose of soil improvement and the prevention of soil erosion. Seed produced from these plots may be used for establishing permanent pastures elsewhere on the farm.

Preparation of Seed-Beds. The preliminary preparation consists in clearing the site of under-growth and rubbish and levelling the land. The area cleared should be in excess of the actual area required for beds, so that a cleared space will be left round the seed-beds. This work is best carried out during the winter months and some time previous to the final preparation of the beds. The soil should receive an application of kraal manure or compost. Where kraal manure is to be used, a liberal application of old, well-rotted, pulverised manure should be broadcast over the site and should be well incorporated with the soil by ploughing or spading. The manure should be applied some time before the final preparation of the seed-beds so that it may be thoroughly decomposed and converted into humus before the beds are seeded. After this the soil should be worked at frequent intervals to destroy most of the weeds before the final preparation of the beds and the remainder will be killed when the soil is sterilized. Compost, used in the place of kraal manure, is applied to the seed-beds after they have been sterilised.

In the final preparation, a short while before the date of seeding, the site is lined off into beds with pathways between. The dimensions of the beds can be arranged to suit the site and the convenience of the grower. Beds can be made any desired length, but it is best to restrict their width to between three and five feet so that the middle of the beds may be easily reached from the pathway on either side. When the beds are too wide, difficulty is experienced in weeding and also in removing transplants without damage to those remaining in the seed-beds. The most convenient width for Virginia type tobacco seed-beds has generally been found to be four feet, and three feet in the case of Turkish type tobacco. Whenever possible, the pathways should not be made narrower than three feet; this width of path provides sufficient room between the beds for watering, weeding and removal of plants.

After the beds are measured and marked off, the top soil in the pathway strips should be thrown up on to the adjoining seed-bed; this operation when completed should leave the beds raised above the level of the pathways. In the case of beds for Turkish tobacco they should be raised at least nine inches above the general level of the ground. This will increase soil drainage during the very wet weather and help to ward off fungus diseases, such as "damping off" and "frogeye." Each bed should then be brought into a fine tilth and be properly levelled prior to being sterilized.

There are several methods of sterilizing the soil, including steaming and burning. Steam sterilization requires the use of a steam boiler, preferably portable, and not less than 20 h.p. capacity, two steam pans three to six feet wide by twelve feet long by eight inches high, and some lengths of steam piping to convey steam from the boiler to the pan. Steam is led into the pan at a pressure of from eighty to a hundred pounds per square inch. The pressure must be maintained at eighty pounds or more throughout the steaming. The pans are inverted and placed in position over the soil to be sterilized.

Steam should be applied to the first for thirty or forty minutes and then steam is led into the second pan while the first remains in position until it has to be moved forward to the next section of the seed-bed to be steamed. The pans must be weighted down to prevent the escape of steam and so ensure thorough sterilization of the soil.

In Southern Rhodesia the open-fire method of sterilizing the soil is the common practice and gives satisfactory results. By the burning process weed and grass seeds are destroyed and insects hibernating in the soil are killed. The brushwood, maize cobs or other material should be placed evenly over the surface of the seed-beds. Burning is best done when there is no wind blowing, so that full benefit may be derived from the heat generated by the burning fuel. Tobacco stalks should not be used for sterilizing seed-beds, as they may cause fresh infection of disease; also when tobacco stalks alone are burned, the ash contains an excess of potash which may adversely affect germination. A layer of dry grass should be placed on the beds, and on top of the grass a layer of maize cobs, about six inches in depth, should follow. A layer of brushwood about two feet deep can be used in place of the maize cobs. This quantity of fuel should be sufficient to effect thorough sterilization of the soil to a depth of three inches or more.

When properly sterilised, the soil will have a light, dull red colour, and will be very friable and easily pulverised. A simple test may be made by burying a potato about three inches below the surface of the soil in the seed-bed before burning. When the potato has been cooked until the skin slips off easily, it will indicate that the soil has been properly sterilized. The beds should not be burned when the soil is saturated with water or, on the other hand, when it is too dry. Best results are obtained when the soil contains just sufficient moisture for cultural operations. After they are sterilised, the beds are allowed to cool before being enclosed with brick borders.

In Rhodesia the usual method is to place a single row of burnt bricks on edge round the outer edge of the seed-bed. A little earth is drawn up against the outer side of the bricks to a depth of about one inch, and lightly tamped down to hold them in place.

After the beds are suitably enclosed, all the unburned pieces of the material used for fuel should be removed. An even depth of about one-half inch of ash should be left on the beds, as it is an excellent fertilizer. If more ash is present, part should be scraped off until the above quantity remains, otherwise there is a danger of the soil becoming too alkaline for proper plant growth.

An application of properly made and well screened compost should be evenly broadcast over the bed at the rate of from two to two-and-a-half petrol tins per ten square yards. The use of badly made compost is liable to have a deleterious effect on the young seedlings and may also introduce insect pests, disease and weed seeds to the beds. The compost should be made according to the simplified process modified by Timson* to suit our local conditions. Compost made from tobacco crop residues, such as primed leaf, scrap and stalks, may harbour tobacco diseases and must, therefore, not be used as the seed-beds might become contaminated.

A dressing of fertilizer may now be applied. There are numerous mixtures and a number of reliable proprietary tobacco seed-bed fertilizers which are also recommended. An excellent mixture can be made up as follows:—

1 lb. superphosphate,
½ lb. nitrate of soda,
½ lb. sulphate of potash.
Mix thoroughly.

This mixture is applied at the rate of two lbs. per ten square yards of seed-bed.

After the fertilizer has been broadcast evenly, the beds should be lightly dug over to a depth of approximately three inches. The unsterilized soil must not be brought to the surface, otherwise weed and grass-seed would be exposed and cause trouble later. Every care should be taken to mix thoroughly the ash, compost and fertiliser with the surface soil. The seed-beds should now be brought to a fairly fine tilth and be properly levelled by means of a hand-rake. When the beds are not level, the seed is liable to be washed down to the lower or hollow sections of the seed-bed surface, thus causing an undesirable uneveness in the stand of seedlings.

To support the seed-bed covering a wire should be stretched down the centre of the bed. Pegs should be driven in at intervals to within twelve inches of the surface, and the wire stretched along the top of them. This completes the preparation necessary before the beds are seeded.

The Time for Sowing. Seed sown early in the season will produce seedlings ready for transplanting usually in about 60 days. Later sowings generally produce seedlings in less time.

The usual time for sowing flue-cured Virginia type tobacco seed-beds is from mid-September to the end of October. This enables the grower to produce seedlings ready for transplanting during the months of November and December. Flue-cured tobacco should not be transplanted after the end of December, as late-planted tobacco seldom produces leaf of good quality, and curing is difficult.

Seed-beds for dark fire-cured, air-cured and sun-cured Virginia type tobacco are sown from the first week in October to the end of November. The seedlings are then ready for transplanting during the months of December and January.

*S. D. TIMSON, M.C.—"Kraal Compost," **Rhodesia Agricultural Journal,** Vol. XXXIX, No. 3, May-June, 1942.

Turkish type tobacco seed-beds are sown from the beginning of December to the middle of January. The seedlings are then ready for transplanting from about mid-January to the end of February. In Matabeleland and other areas of the Colony where the distribution of rainfall is most erratic, the sowing of seed-beds should extend over a period commencing from mid-October and closing at the end of December. The seedlings in this case should be ready for transplanting from the end of November until mid-February.

Sowing the Tobacco Seed. On account of the small size of the tobacco seed there is a tendency by growers who do not fully appreciate the number of seeds contained in a given measure, to sow the beds too thickly. There are approximately three hundred thousand seeds contained in one oz. and an average sized teaspoon will hold about twenty-five thonsand seeds when level full.

When shelled from the seed-pods tobacco seed contains a high percentage of inferior seeds, besides a certain quantity of chaff and dust. These immature seeds and chaff should be removed by passing the seed through a tobacco seed separator which eliminates the trash. Practical and experimental results have proved that tobacco produced from heavy, well-developed seed is more uniform in size and colour, and produces larger yields than crops grown from ungraded seed.

Tobacco seed may be sent to any of the local chemists or firms who undertake the work of cleaning and treating seed.

For those who prefer to treat their own seed the following is the method used: Dissolve 17½ grains silver nitrate crystals in two pints clean, cold water. Soak the seed in this solution for fifteen minutes. Strain through a fine muslin bag and wash thoroughly in frequent changes of clean water until the seed is free from traces of silver nitrate solution. The seed may then be sown wet or be dried for sowing later. When drying, the seed should be thinly spread out on a sheet of paper or cloth placed in the shade and not in the sunlight. Instead of silver nitrate, mercuric chloride or corrosive sublimate may be used at a strength of one in one thousand. Yet another method may be used in the treatment of seed. In this case the seed is treated with a dry mercurial powder, such as "Agrosan," used in the proportion of one part powder to twenty parts of tobacco seed by weight. The seed must be kept dry until it is sown.

When using only properly graded seed the following are the quantities normally applied:—

1 oz. of seed is sufficient to sow 180 square yards.
12 ordinary teaspoons (level full) will sow 180 square yards.
1 ordinary teaspoon (level full) will sow 15 square yards.

Lighter applications of seed than at the above rate of seeding are capable of yielding satisfactory results, but can only be recommended in the case of experienced tobacco growers having suitable facilities and using thoroughly reliable seed.

Under favourable conditions the rate of seeding may be reduced by from one-quarter to one-half, *i.e.*, one oz. of seed per 240 to 360 square yards, instead of the standard recommendation of one oz. per 180 square yards of seed-bed area.

In order to distribute evenly such a small quantity of seed over the given area, it is necessary to mix the seed with wood ash or some other suitable medium. The seed should be thoroughly mixed with the distributing medium in the proportion of one teaspoonful of tobacco seed to about a quart or double handful of wood ash. Some growers prefer to put the requisite quantity of seed in a can of water and, after thorough stirring, apply the mixture of seed and water to the beds. Whatever method is followed, the beds should be well watered on the previous day in order to reduce the quantity of water required immediately after the beds are sown and thus reduce the risk of the seed washing.

When sowing the beds, care should be taken to distribute the seed evenly over the whole surface of the seed-bed. Sowing is best done when the air is calm. Should it be necessary to sow the seed when the wind is blowing, much wastage of seed is prevented and more even seeding made possible by holding up a reed mat or similar contrivance on the windward side of the bed. This improvised windbreak can be moved along so as to enable the person sowing the seed to do so behind the shelter thus provided.

After the seed is sown a light dressing of clean sand should be applied. This serves not only to prevent washing but the sharp grains of sand act also as a deterrent to the small ants which carry away the germinating tobacco seed. The sand must be carefully applied otherwise the seed will be covered too deeply. Immediately afterwards the beds should be watered with a can fitted with a finely perforated rose.

During the early stages of growth of the plants especially, the seed-beds require to be kept moist, but not too wet. Generally, the newly-sown beds are watered in the mornings only, and later on, when the seedlings are bigger, they are watered morning and evening, while at a later stage an additional watering at mid-day may be required. Owing to varying conditions, it is impossible to state how many times a day watering is necessary or the rate of application. A good rule, however, is to have the seed-beds always moist but not too wet. In the case of tobacco seed-beds sown during the latter part of the season, less frequent watering may be found necessary because the requisite moisture is furnished by frequent showers of rain. When plants have leaves slightly larger than a thumb-nail, a more coarsely perforated rose should be used on the cans. Later, for watering larger plants, the use of a rose may be dispensed with and replaced by a small square of tin clipped to the spout of the water can, and bent up in such fashion as to cause the water to fall in a broad, flat spray. Watering must be done with cans or garden hose: irrigation and flooding are not recommended.

Water near the banks of a river, stream or pool is often infested with tobacco root-knot nematode (*Heterodera marioni, Cornu.*) or tobacco eelworm. As a precautionary measure, therefore, water for the seed--beds should be taken from mid-stream, preferably by means of a pump. Where cans or buckets are used a reasonably wide and strong platform should be built out into the middle of the river or pool. Wet utensils should not come into contact with the ground at or near the water's edge, as soil

particles adhering to the bottom of such utensils may carry nematode to the seed-beds.

Wherever possible, growers should make provision for a permanent supply of water from boreholes sunk close to the seed-bed site. This is recommended because water from such a source is free from infestation by tobacco eel-worm.

Tobacco seed-beds should be sown in batches at intervals of about ten days to ensure a continuous supply of seedlings ready for transplanting. Speaking generally, seedlings will be ready for transplanting in from six to eight weeks from the time the seed is sown.

For Virginia type tobacco sufficient beds should be sown at one time to provide plants for at least twenty acres, so that each planting will furnish enough uniform, ripe leaf for the first curings. When this practice is followed the several operations of cultivation and curing can be carried on in proper succession and farm labour can be used to better advantage.

In the case of Turkish type tobacco the seed-beds are generally sown at weekly intervals, and each batch should be sufficient for approximately one-sixth of the total acreage to be planted during the season.

The total area of seed-beds required depends upon the intended acreage and the type of tobacco to be grown. For Virginia type tobacco about twenty square yards will provide sufficient plants for one acre. For Turkish type tobacco a minimum of a hundred square yards is required for each acre to be planted. In Matabeleland and other areas where the rainfall is most erratic, the seed-bed allowance per acre should be increased by about twenty-five per cent. in order to assure an adequate supply of seedlings.

Covering. Immediately after the bed is sown, combed grass is laid flat on the surface to hasten germination of the tobacco seed. Great care must be taken not to leave this grass on the beds after the seedlings appear—usually in about a week—otherwise the plants will grow spindly and die off. When this grass is removed some covering is necessary to protect the young seedlings from direct sunlight and the heat during the day and the cold at night. Either cheese-cloth, combed grass or sunnhemp stalks may be used for this purpose. The most suitable covering is cheese-cloth, and its use is recommended in preference to any other material.

Grass covers are difficult to manipulate in order to give the plants the proper amount of sunlight. If the covering is too thick, the plants are inclined to be lanky and weak. If too thin a covering, the young seedlings are often killed by the surface soil becoming too dry. Such covers also often harbour the moths of the tobacco, "Leafminer" or "Splitworm" *(Phtorimoea operculella, Zell)* and "Stem Borer" *(P. heliopa, Lwr.)*, which pests cause severe damage to the young plants.

The same drawbacks apply to the use of dried sunn hemp stalks, except that manipulation may be somewhat easier, especially where the covers are made in the form of mats which can be removed from the beds as required. Alternatively, the sunn hemp

stalks may be laced to a supporting framework erected over each bed and set horizontally about fourteen inches above the surface. In this case the stalks are placed singly across the frame and are then tied, leaving a space of approximately three-eighths of an inch between each stalk.

On the other hand, cheese-cloth protects the plants from the direct rays of the sun and at the same time allows sufficient light for proper growth. If the beds are properly enclosed, cheese-cloth will keep the beds warm at night and will also protect the plants from insect pests. After use the cheese-cloth should be washed and thoroughly sterilized by boiling in water for about thirty minutes. The cloth should then be properly dried and rolled up for storage until next required. With reasonable care cheese-cloth will last for a number of successive seasons.

In use, the cheese-cloth is either fastened to the wire stretched down the centre of the bed so that one-half of the width of the cloth is on either side, or the edge of the cloth is fastened to a wire stretched along one side. In both cases the edges of the covering are to be pulled over the sides and ends of the bed and held in place by suitable clips or weights placed at intervals on top of the sides of the seed-bed. When it is necessary to uncover the beds the weights (generally stones or bricks) or clips are removed and the covering rolled back until the wire is reached. A double thickness of cheese-cloth should be used on the beds during the first week or ten days after germination in order to protect the young seedlings from the sun. The extra covering should then be removed, leaving only one thickness to cover the bed.

Care of Seed-Beds. At first the cheese-cloth must remain over the beds the whole time, except for the short time they are exposed for watering. When the plants have grown a little, the covering is left off for a short period each morning to allow them more sunlight and prevent weak stems. The period of exposure is gradually lengthened as the seedlings grow, so that by the time they are the right size for transplanting, the covers are left off all day and replaced only at night. This exposure will harden the plants preparatory to transplanting in the field. Tobacco seed-beds require constant care, otherwise the results may prove disastrous. If neglected for a few days, the seedlings may suffer a setback or even die through lack of moisture, or be destroyed by insect pests or plant disease. The beds should be kept well weeded. After the seedlings are large enough for transplanting (roughly six inches high) they should receive only sufficient water to prevent excessive wilting.

Before removing seedlings for transplanting, the seed-bed should be well watered so that the plants can be removed easily and without injury to themselves or the remaining plants. Immediately afterwards the bed should be again watered to firm the soil around the roots of the remaining seedlings in order that their growth may be retarded as little as possible.

The plants in the seed-beds may sometimes fail to make satisfactory growth; this may be caused by insect pests, diseases or unfavourable soil conditions. If the soil is water-logged because it is badly drained then suitable drainage must be provided immediately. If due to the application of too much water, the

rate of watering should be reduced and the soil aerated by light stirring. Excessive alkalinity of the soil will also adversely affect the growth of seedlings, and where this is suspected as the cause of retarded growth or dying off of seedlings, suitably selected samples of seed-bed soil and the water used for watering the beds should be sent to the Agricultural Laboratory for analysis and remedial recommendations by the Chemistry Branch. Seedlings do not make satisfactory growth when the beds are overcrowded; in this case thinning out is necessary.

Should insect pests or plant disease be troublesome, tobacco growers are advised to seek the advice of the Entomological and Plant Pathology Branches, Department of Agriculture.

Retarded growth may be due to lack of plant food, in which case the plants will usually have a sickly yellow appearance. This is especially noticeable when there is a deficiency of nitrogen. Nitrogen may be supplied by means of a solution of nitrate of soda or liquid fowl manure. The latter is to be preferred, as it is cheaper and more easily procured, besides also furnishing a more complete plant food than the nitrate of soda. The nitrate of soda solution is—

1 lb. of nitrate of soda.

8 gallons of water.

The above quantity is sufficient for about 20 square yards of seed-bed.

The liquid fowl manure is prepared in the following manner:—

Take a suitable receptacle and half fill it with fowl manure, then fill up with water. The receptacle should be allowed to stand in the shade for about five or six days, and its contents stirred at frequent intervals. After standing for this period the liquid should be strained ready for use. One gallon of liquid fowl manure should be diluted in eight gallons of water. This should be applied to ten square yards of seed-bed. After a few days a second application may be given.

The usual proprietary tobacco fertilizer mixtures can be used for stimulating the growth of backward plants, and is applied broadcast or in solution at the rate of one pound per ten square yards.

None of the foregoing should be applied to young seedlings with leaves smaller than a threepenny piece.

Immediately after treatment the seed-bed should be watered to wash the solutions or fertilizer from the plants to prevent the leaves from being burned. Also, when possible, application should be made on a dull, cloudy day or be deferred until late afternoon in order to reduce the risk of the leaves being scorched.

SUMMARY.

1. Use discretion in the selection of the seed-bed area and pick the best site.

2. Make sure that the site is close to a permanent, uncontaminated and adequate supply of water.

3. Use the same ground for seed-beds but once in every four or five years, and practice crop-rotation.

4. Provide suitable drainage for seed-beds, and erect wind-breaks where necessary.

5. Make the beds and pathways a convenient width, and prepare the seed-beds thoroughly before seeding; they cannot be prepared afterwards.

6. Sterilize the seed-bed soil.

7. Use good seed, properly cleaned and treated.

8. Use the correct quantity of seed in sowing; thickly seeded beds usually mean poor plants.

9. Sow the beds at proper intervals, to give a good succession of suitable plants for transplanting.

10. Water seed-beds so that they are kept moist, but not too wet.

11. Spray regularly with suitable fungicide to protect the seedlings from disease, and handle the plants as little as possible.

12. Keep the immediate surroundings of beds clear of all undergrowth and trash; this helps to control insect pests and reduces the fire hazard.

13. Use only fertilizer of good quality and properly made compost for application to seed-beds.

14. Have plants the correct size for transplanting—six inches—long, lanky plants and undersized plants seldom give satisfactory results.

15. Always soak the beds before removing seedlings for transplanting and water again immediately afterwards.

16. When planting operations are completed remove and destroy all surplus plants and dig over the seed-beds.

17. When cheese-cloth covering is no longer required, remove it and after being washed, sterilized and dried, roll it up and store safely until required for use next season.

18. Spare no effort to produce good, strong and healthy seedlings; good crops are seldom grown from inferior plants.

Tsetse Fly Operations in Southern Rhodesia.

SHORT SURVEY OF THE SITUATION IN THE YEAR ENDED DECEMBER, 1946.

By J. K. CHORLEY, Chief Entomologist, Department of Agriculture.

[Extract from the Annual Report of the Division of Entomology.]

In all the northern areas steady progress has been made, fly (*Glossina morsitans*) densities have been further reduced over the area covered by game elimination operations and additional protection has been given to the areas previously cleared. The advance line of hunters has not been changed since 1940, and until such time as they are again moved forward it will not be possible to reclaim much more land. The mopping up of a few isolated foci of fly in the Sebungwe, Hartley and Urungwe areas is about all that remains to be achieved to complete the present authorised programme of work. Once this has been accomplished, approximately 10,000 square miles of territory will have been cleared. In the Doma and Darwin areas accelerated progress can be expected in view of the decision to destroy or drive out the once numerous herds of elephant which had previously been protected and which afford the fly a dependable source of food.

The threat of invasion of the Mtoko district by the same species of tsetse spreading from Portuguese East Africa has increased, and early defensive action may soon become necessary. The position on the Eastern Border (Chipinga) shows a steady and progressive improvement, the number of cases of animal trypanosomiasis which occurred being fewer than in previous years, *G. pallidipes* being the main culprit.

On the Eastern Border, in the low veld south of Chikore, the *G. morsitans* position has steadily deteriorated and heavy losses of stock have occurred. The density of fly in Portuguese East Africa has increased rapidly and dense fly can now be found within one mile of the border in the vicinity of the Honde River. The few head of cattle remaining alive at Mahenya's and in the Honde Dip Tank Area have been removed to the Sabi River.

An increase in human trypanosomiasis has been recorded from the Zambesi Valley in the Urungwe district. Thirteen native cases were diagnosed, the highest for many years.

CONFERENCES AND COMMITTEES.

Trypanosomiasis Committee. Six meetings of the inter-departmental Trypanosomiasis Committee were held. The principal matters discussed included the continued deterioration of the position on the Eastern Border south of Chikore, the test cattle on the Karoi block, the sleeping sickness epidemic in the Feira area of Northern Rhodesia, the purchase of Chief Mahenya's cattle, the creation of a cattle-free belt along the Eastern Border, arrangements for Professor P. A. Buxton's visit, arrangements for the Tsetse and Trypanosomiasis Conference at Lourenco Marques, the provision of a demonstration farm in the Chipinga area, the draft National Parks Bill, the appointment of two Entomologists from funds to be provided by the Beit Trustees for work on tsetse and D.D.T., etc., the increase in human trypanosomiasis in the Zambesi Valley and a proposal from the Natural Resources Board for further chemotherapeutical research.

Professor P. A. Buxton and Dr. Jacinto de Sousa attended meetings of the Committee.

Central African Council Standing Committee on Tsetse and Trypanosomiasis. Two meetings were held, one in Salisbury and one in Lusaka.

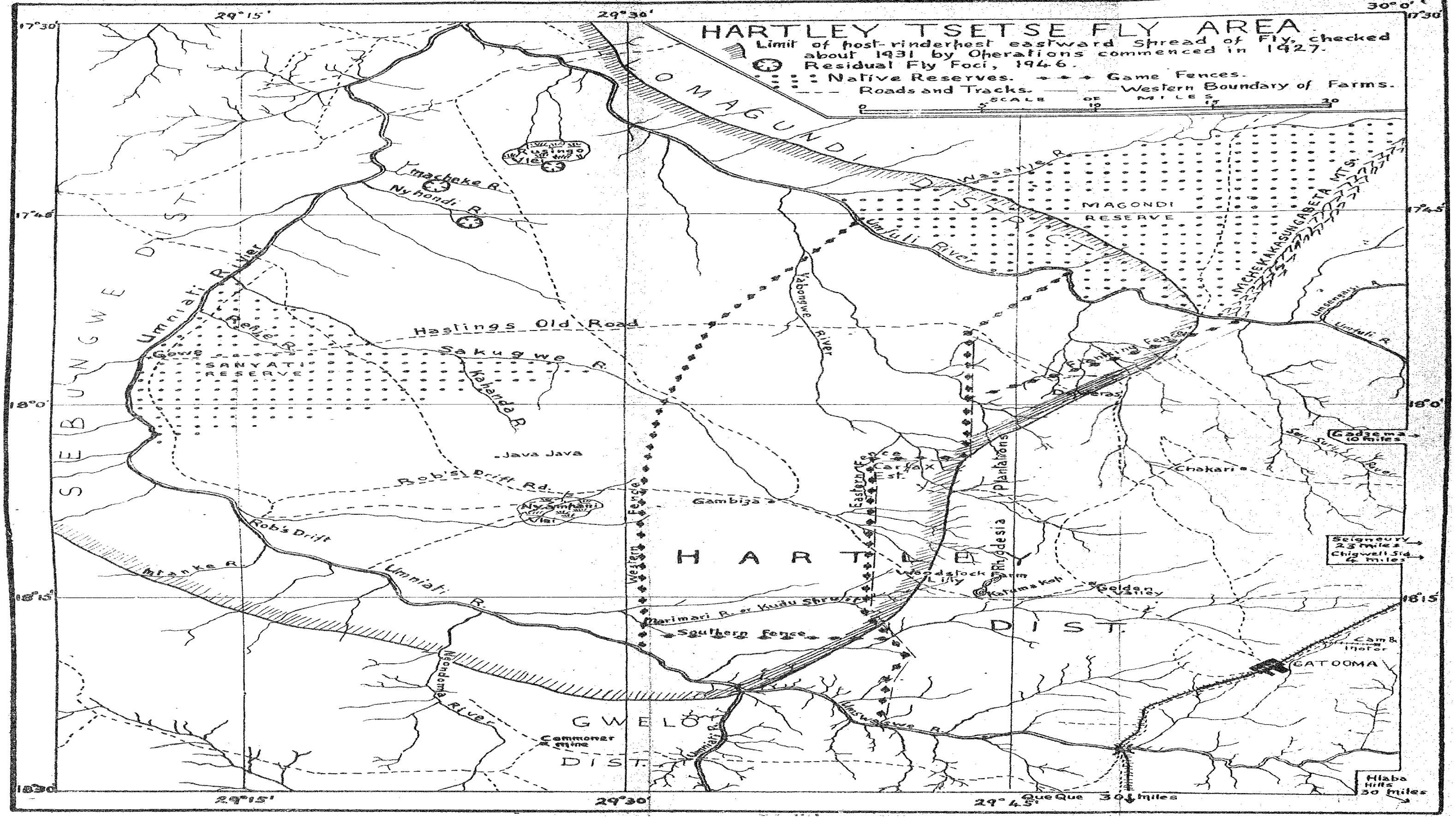
Visitors. Professor P. A. Buxton, F.R.S., Professor of Entomology, London School of Hygiene and Tropical Medicine, visited the Colony on behalf of the Colonial Office Tsetse Fly and Trypanosomiasis Committee and on the invitation of Government. The visit was made during a tour of South and Central Africa to investigate tsetse and trypanosomiasis problems, and the preservation of game. He had visited East Africa during 1945.

During his stay visits were made to the Eastern Border (Chipinga area) and the Doma and Urungwe tsetse areas. Arrangements were also made for him to meet a number of people interested in the tsetse problem. Closer relation with the East African Tsetse and Trypanosomiasis Research organisation was discussed.

Sir Ian Heilbron, F.R.S., Professor of Organic Chemistry, University of London, and Dr. J. L. Simonsen, F.R.S., Director, Colonial Products Research Council, attended a special meeting arranged to discuss matters connected with the development of new insecticides and new chemicals for the treatment of tropical diseases of man and animals. Their visit was made on behalf of the Colonial Products Research Council during a tour of East and South Africa.

Sir Guy Marshall, a former Director of the Imperial Institute of Entomology, spent some time in the office discussing entomological matters and the development of control measures.

The Lourenco Marques Tsetse and Trypanosomiasis Conference. Six delegates attended the International Conference on Tsetse and Trypanosomiasis arranged by the Government of Mozambique. They were Dr. G. R. Ross, Assistant Director of Medical Services; Mr. P. Huston, Chief Veterinary Surgeon; Mr. D. A. Lawrence, Director of Veterinary Research; Mr. E. J. Kelly Edwards, Conservator of Forests; Mr. E. Hudson Beck, Chief Native Commissioner; and the writer. Mr. W. A. W. Clark attended on behalf of the Central African Council. Delegations


HARTLEY TSETSE FLY AREA
Limit of post-rinderpest eastward Spread of Fly, checked about 1931 by Operations commenced in 1927.
Residual Fly Foci, 1946.
Native Reserves.
Game Fences.
Roads and Tracks.
Western Boundary of Farms.
SCALE OF MILES
0 5 10 15 20
29°15'
29°30'
29°45'
30°0'
17°30'
17°45'
18°0'
18°15'
18°30'
SEBUNGWE DIST.
LOMAGUNDI DISTRICT
GWELO DIST.
HARTLEY DIST.
MAGONDI RESERVE
SANYATI RESERVE
Umniati River
Umfuli River
Wasanje R.
Umsengaisi R.
Umfuli R.
Mchekakasungabeta Mts.
Imacheke R.
Nyhondi R.
Rusingo Vlei
Yabongwe River
Hastings Old Road
Rekie R.
Gowe
Sakugwe R.
Kahande R.
Java Java
Rob's Drift Rd.
Nyamhani Vlei
Rob's Drift
Mtanke R.
Umniati R.
Gambiza
Western Fence
Eastern Fence
Carfax Est.
Plantations
Rhodesia
Woodstock Farm
Lily
Katumakoli
Golden Valley
Marimari R. or Kudu Shruit
Southern Fence
Ngondoma River
Commoner Mine
Umniati R.
Umsweswe R.
Chakari
Gadzema 10 miles
Sell Suri River
Seigneury 23 miles
Chigwell Sid. 4 miles
Cam & Motor
GATOOMA
Hlaba Hills 30 miles
Que Que 30 miles
Dalveras
Fleming Fence

attended from Angola, Mozambique, the Union of South Africa, Southern Rhodesia, Northern Rhodesia, Nyasaland, Tanganyika, Kenya, Swaziland and Bechuanaland. The Conference recognised the great diversity of the tsetse problems in the various African Territories which made the adoption of any uniform method of control impossible. Among other matters, it was agreed to recommend to Governments the closest collaboration in all matters affecting the control of tsetse and trypanosomiasis, and the regular and early exchange of information. Delegates were the guests of the Government of Mozambique during the period of the Conference.

GAME DESTROYED.

Owing to the shortage of Martini Henry ammunition, the number of rounds of ammunition expended each month was cut by 50 per cent. in November, and the destruction of the smaller game, including Steinbuck, Sharpe's Steinbuck, Oribi, Klipspringer, Blue Duiker and Livingstone's Suni was stopped.

A total of 24,351 head of game were destroyed in all areas for an expenditure of 53,576 rounds of ammunition, or 2.2 rounds per head. The amount of each species killed was:—

Elephant	15	Steinbuck	203
Rhinoceros	19	Sharpe's Steinbuck	2,275
Buffalo	276	Klipspringer	517
Zebra	227	Oribi	104
Eland	310	Livingstone's Suni	33
Kudu	3,289	Warthog	2,886
Roan	100	Bush Pig	516
Sable	854	Lion	9
Wildebeeste	70	Leopard	23
Hartebeeste	9	Cheetah	1
Waterbuck	361	Hyaena	6
Tsessebe	61	Baboon	1,844
Reitbuck	627	Wild Dog	9
Impala	1,603	Cat	2
Bushbuck	1,819	Lynx	1
Duiker	6,282		

SHORT SURVEY OF THE TSETSE FLY OPERATIONS BY DISTRICTS.

Darwin. Further progressive reductions in fly densities (*G. morsitans*) can be reported from the comparatively small area of the Darwin district which still remains infested with tsetse. In view, however, of the possibility of human sleeping sickness becoming established in the densely populated area along the Umsengedzi River, it was considered desirable to accelerate progress. If a material reduction in fly densities could be rapidly brought about the possibility of any serious outbreak of sleeping sickness occurring could, it was considered, be averted. The main factor in delaying progress has for years been the presence of permanent herds of elephant in the thicket country along the Kadzarui River and around Chief Mzarabani's. Early in the year that portion of

the Darwin district lying west of the Hoya River was declared an "open" area for the destruction of all classes of game except rhinoceros, giraffe, nyala, hippopotamus and birds. Giraffe and nyala do not occur in the area, while hippopotamus are not a reliable source of feed for *morsitans*. Special protection was given to the rhinoceros as these animals are not common in the area and they would very soon have been exterminated.

In all, about 5 elephant by the Department and 14 by the general public have been destroyed. Some of the elephant have temporarily left the area, having taken refuge east of the Hoya River. The remaining herds have scattered. The results of this intensified campaign should result in the eradication of tsetse from most of the Mzarabani Native Reserve within the next few years. Along the international border infiltration of tsetse from Portuguese East Africa will continue to occur, and there is a definite danger that our operations will be outflanked by the eastward spread of the fly along the Zambesi Valley in Portuguese East Africa.

During the year a few head of native cattle have been moved to Kaitano's Kraal, on the Massingwa River, an area only recently cleared of the fly. A small herd of cattle have been kept at the Umsengedzi Mission, and a few deaths have occurred, presumably from trypanosomiasis.

Lomagundi (Doma). The destruction of elephant in the area covered by tsetse fly operations between the Angwa and the Kadzi Rivers was authorised by the same Proclamation authorising the destruction of elephant in the Darwin district and for the same reasons. There has been a slight but progressive decrease in fly densities recorded over most of the area except on the western edge along the Angwa River, which is subject to continuous incursions of both game and tsetse (*G. morsitans*). Elephant and rhinoceros are more numerous along the Angwa River than anywhere else in the area. The elephant have not yet been sufficiently persecuted to force them to seek refuge west of the Angwa.

No tsetse were seen south of the Escarpment during the year.

A number of farms have been settled by returned service men in the old fenced area south of Doma.

A new motor road has been cut down the escarpment at Sipolilo and has reached the Hunyani River. A traffic cleansing chamber will be erected on this road during 1947.

Urungwe. Very little change occurred in this area and the general position remains satisfactory. *G. morsitans* still persists in small numbers west of the Urungwe Native Reserve, though a progressive decline in fly densities has occurred. North of the Reserve dense fly occurs on the Naodsa and in the vicinity of Chipane and Gota Gota, areas which have only recently been included in the zone of operations. North of the Mkwechi River the fly position remains much the same, odd flies being found north of Manyangau Hill. Near the Escarpment fairly dense fly occurs on the Rekomitje and Cheore Rivers. The main road between Makute and Chirundu remains lightly infested with fly.

The three test herds of cattle which were placed on the Karoi block of farms early in 1945 were handed over to the Miami Farmers' Association for distribution to the settlers in August. During the

17 months they were in the area only one case of trypanosomiasis had occurred. This was on K.92, in the most northerly group of farms. The main object of the experiment, which was to demonstrate that the danger from trypanosomiasis was absent or negligible, had been achieved.

No cases of trypanosomiasis have been reported among the 4,500 head of native cattle in the Reserve, and no cases have been reported from the cattle in the European settlement. A few cases occurred on the northern farms close to Vuti cleansing station, beyond the settlement, five positive smears being recorded. These were not unexpected, as the affected farms are situated close to known fly on the Rekomitje River.

Lomagundi S.-W. The general position in this *morsitans* area remains satisfactory. No tsetse were seen in the cleared areas north of the Umfuli River. South of the Umfuli, in the Hartley district, fly still persists in very small numbers in the vicinity of Ruswingo vlei and the Mcheke River. West of the Sanyati River, fly appears to have been completely eradicated from the vicinity of the Emerald Mine and Copper Queen Mine areas.

Hartley. In view of the almost complete extermination of tsetse, *G. morsitans*, from the Hartley district (see map), this is perhaps an opportune moment to give a brief outline of the history of tsetse in this area. It is difficult to get accurate information regarding the distribution of tsetse in the Colony prior to its occupation in 1890. From early records and maps dating back to 1870 it is known that a huge belt of tsetse covered the country west of a line running from the vicinity of Gado Siding, just south of Que Que, thence following the western edge of the Hlaba Hills to the Umfuli River near the Seigneury Mine. From here the edge of the belt ran north-west towards Gadzema. In 1892 Mr. Charles White, Mining Commissioner, mapped the distribution of tsetse in this area. Not all of the country west of this line would have been permanently infested with tsetse, as the distribution of the fly would depend on the distribution of types of forest forming a natural habitat for the fly, and the presence of game. The eastern edge of the fly belt followed fairly closely the 4,000 contour line, and on all modern maps showing the distribution of tsetse at that time, the whole of the area is shown as being infested. The early hunters and prospectors kept to the east of this line when trekking with ox transport to the north.

After the rinderpest epizootic in 1896 the main fly belt contracted enormously, but left behind small isolated foci at a number of points later described as residual foci. One of these was on the Surri Surri River in the vicinity of Chigwell Siding, another was near the junction of the Yabongwe and Umfuli Rivers, and a third in the vicinity of Gowe, on the Umniati River. The track known as Hastings' Old Road was cut through westwards to Gowe, on the Umniati River, in 1899, and was at that time probably free from tsetse.

Extensive areas surrounding the known fly belts in the Hartley district were first thrown open to free shooting in 1901 for a period of three months. In 1905 the Game Laws were again suspended, Zebra, Elephant, Rhinoceros, Hippopotamus and Ostrich being excluded. This suspension of the Game Laws lasted until 1908. On

account of heavy losses of stock, the infested areas were again re-opened to free shooting in 1909 and remained open until 1928.

In 1913 the Cam and Motor Mine ran a light railway into the Surri Surri fly belt for the purpose of cutting mine timber. The destruction of the natural forests, combined with the rapid destruction of the game, finally brought about the complete extermination of tsetse and trypanosomiasis in that residual focus in about 1916. The year of greatest losses occurred in 1908, when there was great mining and agricultural development in the area, resulting in much greater contact between man, cattle and fly. There is no evidence that 1908 was a year of intense fly activity.

The other two residual foci at Gowe and on the Yabongwe River were much further away from the railway line and centre of active development, and remained comparatively undisturbed notwithstanding the declaration of an open shooting area. With the natural increase in game, they slowly expanded, tending in all directions to re-occupy the area covered prior to the rinderpest epizootic.

In 1921 the writer confirmed the presence of fly in the Rob's Drift area; it had spread some 18 miles up the Umniati River since 1910. The eastern limit of the belt was in the vicinity of Java Java. Between 1922 and 1924 there occurred a rapid spread towards the Golden Valley, fly being reported at Gambeza in 1924—a spread of about 11 miles.

In the following year a number of settlers took up land under the Empire Settlement Scheme west of the Golden Valley, neither the Lands Department nor the Entomological Branch realising the rapidity of the fly-spread. Later in the year further encroachments of the fly were reported, first on the Umfuli River towards Chakari, near Katuma Kop, six miles from the Golden Valley, and on the Mtanka River, several miles above Rob's Drift, on the Umniati River.

Animal Trypanosomiasis was reported from a number of farms in the Chakari and Golden Valley areas early in 1926, and the Gatooma Farmers' Association began to press Government for immediate action. In July plans were made to conserve the grass over a very large area lying west of Rhodesia Plantations, and a three days' burn and game drive was organised in August. It was impossible to evaluate the results of the burn and game drive. Local opinion was convinced that the main result was to scatter both game and fly. What was certain was that the position continued to deteriorate.

By August it was clear that very determined efforts would have to be made to stem the eastward advance of the fly, and a decision was taken to erect two roughly parallel game fences some ten miles apart extending from Kudu Spruit to the Umfuli River. Survey work in connection with the eastern fence commenced in November, 1926. The eastern fence was finished early in 1927, the western fence in March, 1928. In all, about 110 miles of game fences were erected. These were strong fences consisting of eight strands of barbed wire, six feet six inches high, stapled on to living trees and hard wood poles. In the meantime, a European Tsetse Fly Ranger and 25 native hunters had been appointed, namely, in August, 1927.

Heavy losses of stock occurred during 1928 on Carfax Estate, Rhodesia Plantations and other farms in the area. Losses were also reported at the Commoner Mine, on the Ngondoma River, in the Gwelo district, and on the Wasange River, in the Magondi Native Reserve, in the Lomagundi district. To counter the northern advance along the Umfuli River, a flanking fence across Deweras Estate was erected at the beginning of 1930. The number of native hunters was increased to 40 in May, 1929, and to 50 in March, 1930. A second European Ranger was appointed to the Hartley area in 1929, and a third in 1930.

The continued advance of fly along the Umniati River in the Ngondoma area was now causing anxiety—it threatened to outflank the game fences, as fly had established itself above the junction of the Umniati and Umsweswe Rivers. In September, 1930, another European Ranger and 20 native hunters were employed in the Ngondoma area, and in November a European Ranger and 15 hunters were appointed for the area north of the Umfuli east of the Mchekekasungabeta Mountains. In addition to these five European Rangers, a number of special fly inspectors were at different times employed.

The years 1930 and 1931 saw the maximum dispersal of the tsetse and also the beginning of the retrogression. The incidence of trypanosomiasis over the area began to decrease. Parliament passed the Tsetse Fly Act in 1929, and early in 1930 a cleansing chamber for de-flying traffic on the Rob's Drift road was opened. In view of the improvement in the position, as indicated by the reduction in fly densities within the fenced area, the chamber was moved from the eastern fence to Gambeza in 1933. The figures of fly caught at this chamber are indicative of the gradual improvement in the area in subsequent years. As they are of particular interest, they are given in detail:—

1930, 414 (in 9 months); 1931, 687; 1932, 377; 1933, 498; 1934, 478; 1935, 36; 1936, 9; 1937, nil.

The last fly was caught in December, 1936, and the chamber closed down in August, 1937.

In July, 1932, controlled shooting operations were extended to a zone 10 miles west of the western fence, as experience in the Doma area had shown that a 10-mile wide game-free belt was insufficient to prevent all flies from crossing the area. This extension involved the increase of the native hunters' strength to its maximum of 100. After five more years, operations were extended to the Umniati River, including both of its banks. The flanking fence was dismantled in 1936, and all the remaining fences in 1941.

A very careful watch had been kept of the effect of shooting operations on the density of fly in the area covered, and certain control counts were made outside the area. The year 1930 saw the beginning of the reduction in fly densities inside the fenced zone, but it was not until 1936 that this zone was considered to be free from fly. By 1941 fly had been eradicated over most of the area south of the Sakungwe River, but persisted at certain especially favourable spots in the vicinity of Gowe and on the Kahanda River, in the Sanyati Native Reserve. These isolated foci where only odd fly persisted were cleared up by 1945. North of the Sakungwe River fly still persists in very small numbers—one or two a month being

recorded on the Nyhondi River and in the vicinity of Ruswingo Vlei. These foci are expected to disappear during the coming year.

It must not be thought that everything went according to plan. In the early years there were set-backs and disappointments, and an apprehensive and critical public to face. On several occasions the expanding fly belt threatened to outflank the operations. Shooting had to be extended to cover many of the farms east of the eastern fence, but the steady pressure on the game inside the fenced zone was never abated; in fact, it was continually increased, the maximum number of hunters—100—being employed in 1932.

It is possible that the Department did not intensify the operations soon enough. It took from 1927 to 1932 to build up the maximum strength of hunters, and it is a reasonable criticism that attack in depth, i.e., over a zone 20 miles deep, was not adopted sooner. But the lesson was learnt after much bitter experience and successfully applied in the later stages.

Actual reclamation of infested areas did not really begin until the policy of shooting over a 20-mile wide zone was adopted. Further advances were made by leap-frogging the hunters from the back areas to forward areas, particular attention being paid to known high density centres.

During the peak of the campaign many of the settlers became so financially embarrassed that Government assisted by providing working oxen to replace cattle that had died from trypanosomiasis. An inoculation camp was maintained at the Lilly Outspan and sick animals replaced by healthy or cured ones.

In 1932 Government took over Woodstock Farm as a demonstration and trypanosomiasis research station. This station was maintained until September, 1935. The Director of Veterinary Research, reporting on this station, stated that during the period 20 out of a total of 33 susceptible animals introduced on to the farm contracted trypanosomiasis. One untreated control ox exhibited a high degree of natural resistance, having shown trypanosomes in the blood on six occasions between October, 1933, and February, 1935. This ox worked regularly and remained in good condition.

The conclusion drawn by the Director of Veterinary Research from this experiment was: "In the Golden Valley 'fly' area it is quite practicable to maintain cattle in a fit condition for work, milk production and breeding, provided a proper system of management be adopted and the recommendations of the Department concerning the detection and treatment of cases of trypanosomiasis be practised."

That was a valid conclusion in 1935, but it must be remembered that in that year fly had been almost eradicated from the fenced zone and finally disappeared in the following year. It is possible that the results would not have been so successful if the cattle had been subject to repeated and constant attack by tsetse as they were in the earlier years.

The area in the vicinity of Gowe had for many years been considered to be a sleeping sickness area, and in 1912 Chief Nouse and his people were evacuated from the Sanyati Reserve, although there is no definite evidence that any cases of sleeping sickness were actually contracted in the area. It is probable that all the

early cases diagnosed contracted the disease in the Sebungwe sleeping sickness area centred round the junction of the Busi and Sengwa Rivers. But in 1933 two European cases of the disease and six native cases were diagnosed from the Gowe area. One of the European cases and three native cases proved fatal. During 1934 six more native cases were diagnosed, three of which were fatal. Once again those native squatters who had returned to the Umniati River were removed from the area around Gowe. Probably through some oversight, Mazarabani's people on the Renje River were left, even though these people obtained their drinking water at Gowe when their wells on the Renje dried up at the end of the dry season.

To add to one's worries, there were the usual troubles associated with any large gang of native labourers: murder and suicide, rape, arson, theft and assault.

The area around Gowe had been used as a tsetse research centre during 1921, 1922 and 1923. A camp for the collection of tsetse puparia for research in Salisbury was re-established there in 1936. In 1937, despite the possibility of an outbreak of sleeping sickness amongst the native hunters, a decision was made to go in and clean the area up. These efforts have been successful, and as far as is known, no cases of sleeping sickness have been recorded since 1934.

Plans for the development of the Sanyati Native Reserve by the Native Affairs Department are now being made. Some of the land along the east bank of the Umniati River has been surveyed for grazing and arable areas and dam sites have been chosen. During 1947 a number of natives with their cattle will be moved from Rhodesdale Estate to the Umniati. For the first time since the occupation of the Colony in 1890—in fact, for the first time within our knowledge—will cattle be running freely in this area.

During 1930 and 1931 a considerable amount of experimental work was carried out at Nyampani Vlei testing out various designs of traps against *G. morsitans*. This work proved, and the results have been confirmed in other parts of Africa, that *morsitans* is not attracted to traps as readily as *G. pallidipes*, and that the traps are only really attractive during periods of high temperature and low humidity, and comparative absence of shade. Such conditions, in Southern Rhodesia, are only found during September and October.

With the gradual reduction in fly densities, all research activities had to be moved to more remote areas in the Urungwe district.

One of the reasons why fly has persisted so tenaciously in certain localised areas and so prevented an earlier cleaning up of the whole area has been the adopted policy of protecting elephant. Whether this has been a mistaken policy or not remains to be seen, but it is difficult to see how a healthy native agricultural settlement can be established in the presence of elephant. It is probable that an early decision will have to be taken to destroy or drive the few herds of elephant out of the Sanyati Reserve. Some relaxation of the present policy has already been made during the year, and a number of permits issued for the destruction of a limited number of elephant.

The development of the Sanyati Native Reserve might well be used as a criterion of the success of the policy of tsetse control by means of game destruction, but, since there are no dipping facilities in the Reserve and the immigrant cattle are accustomed to such facilities, due caution will need to be observed in pronouncing the cause of death of any domestic animal.

Sebungwe (late Wankie). In the Sebungwe district there is little change to report in the position, which remains satisfactory. All the gains previously made have been held and fly reduced in density in the northern areas north of the Mkulugusi forest belt. Fly is still fairly numerous on the Nagupandi River, but as this river forms the northern boundary of the area, it is unlikely that any great improvement will occur until the line of operations is again pushed forward.

The Karna block on the Shangani River has been bought and is being developed as a cattle ranch. The native people who formerly occupied the ranch have been moved, together with their cattle, further north towards the headwaters of the Dongamusi River. This ranch was first purchased in 1909, but was invaded by tsetse about 1915 and never developed.

Eight head of cattle have been taken to Chief Pashu's, on the Manyande River, an area which cannot yet be considered as absolutely cleared of tsetse. There have been no cattle in this area since it was over-run by *G. morsitans* about 1915. Further development has taken place in the native areas west of the Shangani Reserve, which was cleared of fly some years ago. European settlement is again taking place along the Gwaai River.

Mtoko. Although no tsetse have actually been seen inside the Colony, the incidence of animal trypanosomiasis increased rapidly. One European cattle owner estimates that he had 64 cases before transferring his cattle to the Lomagundi district. No cases have been reported amongst native-owned cattle.

A tsetse and trypanosomiasis survey on the Portuguese side of the border was carried out by Dr. Jacinto de Sousa and Mr. H. E. Hornby, of the "Missao de Combate as Trypanosomiasis," Colonia de Mocambique. Whatever steps are taken by the Portuguese Government to implement the recommendations made in their report, active steps will soon have to be taken to prevent the spread of fly into the Colony.

Umtali. Seven positive cases of trypanosomiasis were diagnosed from cattle running in the vicinity of the Portuguese border just east of Umtali township. In August, 11 specimens of *G. morsitans* were sent in for identification, stated to have been caught close to the railway line close to the Portuguese border. A careful reconnaissance survey of all the border farms in the area and adjacent areas in Portuguese East Africa was carried out by an experienced Tsetse Fly Ranger during November and December. No further specimens of tsetse could be found. It is difficult to explain the complete disappearance of fly from what appeared to be a small but well-established focus. The position will require very careful watching.

Eastern Border (Chipinga). 54 positive cases of trypanosomiasis were diagnosed, involving 18 farms, compared with 132 cases, involving 23 farms, during 1945, 63 cases and 17 farms in 1944,

272 cases and 34 farms in 1943, and 306 cases and 36 farms in 1942. This steady and progressive improvement in the position is most satisfactory, and one can hope that it will be maintained. Actually, the position is much better than indicated by the figures, as owing to the strict veterinary supervision of the area, probably all cases are now diagnosed, whereas in the earlier years probably only one-third of the cases occurring were diagnosed by blood smears.

The total number of tsetse caught on or near the border clearing was 59, compared with 167 in 1945. Only two of these flies—two *G. morsitans*—were caught in Southern Rhodesia, compared with 24 in 1945. Of the tsetse caught this year, 39 were *G. pallidipes*, 1 *G. brevipalpis* and 19 *G. morsitans*. All except one fly were caught in traps. The decrease in the number of *G. brevipalpis* and *G. pallidipes* caught in Southern Rhodesia as compared with previous years is accounted for by the cutting out of some heavily forested ravines in the Inyamadzi Valley on Grampians Farm.

The main clearing was widened on Grampians and Mount Selinda, and the subsidiary clearing on Grampians was also widened. The southern half of Lettie Swan Farm was partially cleared, leaving an open, park-like effect with sufficient shade for cattle. The whole of the clearing was burnt off during September and early October, a very good burn being obtained. That portion of Mount Selinda forest on Gungunyana was again protected from fire. These fireguards have been put in each year since the Government purchased the farm.

A number of cases of animal trypanosomiasis occurred on two farms in the Melsetter district. These farms are situated in a mountainous area above the normal limit of fly. They are connected, however, by forest leaders with low-lying valleys on the Portuguese border, known to be infested by *G. pallidipes* and *G. brevipalpis*. One *G. pallidipes* was taken on the border.

Sabi Valley. Owing to administrative difficulties and shortage of water and grazing, it was found impossible to create the cattle-free zone along the border from Musangazi Dip to the Sabi-Lundi junction authorised last year. The few head of cattle left alive at Chief Mahenya's, namely, 60 head, were purchased by Government and moved to the Hippo Mine Camp. Seventeen of these have been sold, 21 have died and 22 head are left. During October all the cattle remaining at Honde, 186 head, were moved to Chisumbanje, on the Sabi River, where arrangements were made to herd them. Here, late in December, all the cattle that were left, approximately 150 head, were smeared and treated with Phenanthridinium 1553. Only four positive cases of trypanosomiasis were recorded. During the past four years the numbers of cattle in the Honde Dip Tank area have been reduced from over 1,000 head to approximately 150. Losses of stock at Mwangazi and Muumbe Dip Tanks have been heavy.

A very heavy infestation of *G. morsitans* was located on the Ndanga River, in Portuguese East Africa, within one mile of the border, and 42 were taken inside Rhodesia on the same river over a three-day period. A few tsetse at other points on the border were also collected.

South of the Sabi River, in Portuguese East Africa, the edge of the fly belt appears to have remained stationary about 20 miles from the border.

No shooting was carried out in the Ndanga district during the year in order to assist the Veterinary Department in suppressing an outbreak of Foot and Mouth Disease which occurred in 1944. No deaths from trypanosomiasis have occurred in the Ndanga district.

TRAFFIC CONTROL.

The number of traffic cleansing stations and pickets remained the same, all being situated in the Urungwe district. No marked change has occurred in the number of fly being caught at each examination point.

The following traffic was examined at these stations:—

(a) *Vuti Chamber.*—

1,281 motor cars bringing .... 8 fly (4 male, 4 female)
1,732 pedestrians, 394 cyclists
(762 parties) bringing ..... 15 fly (11 male, 4 female)

Total .... 23 fly (15 male, 8 female)

Compared with: 1932 (106); 1933 (94); 1934 (178); 1935 (454); 1936 (519); 1937 (241); 1938 (162); 1939 (62); 1940 (25); 1941 (67); 1942 (49); 1943 (56); 1944 (27); 1945 (29).

(b) *Catkin Chamber.*—

492 motor cars bringing .... 21 fly (15 male, 6 female)
1,276 pedestrians, 307 cyclists
(743 parties) bringing ..... 16 fly (14 male, 2 female)

Total .... 37 fly (29 male, 8 female)

Compared with: 1944 (15; 5 months only); 1945 (61).

(c) *Makute Gate.*—

1,066 motor cars bringing ...... 369 fly (286 male, 83 female)
1,247 pedestrians, 161 cyclists (485 parties) bringing .... 334 fly (242 male, 92 female)

Total .... 703 fly (528 male, 175 female)

Compared with: 1944 (100; 4 months only); 1945 (562).

(d) *Chirundu Gate.*—

(These figures are incomplete.)

907 motor cars bringing ...... 184 fly
1,746 pedestrians, 93 cyclists
(240 parties) bringing 135 fly

Total .... 319 fly (232 male, 87 female)

Previous figures (complete): 1940 (360); 1941 (119); 1942 (276); 1943 (746); 1944 (437); 1945 (485).

The Sunflower

(*HELIANTHUS ANNUUS*).

[Bulletin No. 681, revised.]

By S. D. TIMSON, M.C., Agriculturist.

The sunflower is a summer annual belonging to the natural order *Compositae*. It has large disc-shaped heads on which the seeds are borne. The plant grows to a height of 4 to 10 feet under suitable conditions and depending on variety, and the heads may reach a diameter of 22 inches or even more.

Varieties. There are four principal varieties of sunflower in cultivation: (1) The small-seeded Black Russian; (2) the large-seeded Black Russian; (3) the striped or common, with striped or grey seed; and (4) the white-seeded.

The small-seeded Black Russian produces the heaviest seed and its weight per bushel runs up to 40 lbs. in Southern Rhodesia. The striped and large Black Russian come next in weight, and their bushel weight reaches about 36 lbs. The seed of the white variety is usually very much lighter than the others, and frequently many of the seed husks are empty, containing no kernel. Its weight per bushel may run up to about 32 lbs., but more frequently is under this unless very carefully winnowed several times.

The kernels of the small-seeded Black Russian usually entirely fill the husk, but those of the striped and large-seeded Black Russian do not generally fill the husk completely. The seed of the Black Russian and the striped varieties should breed moderately true, but the white variety is usually found to produce a good deal of grey and striped seed. Small-seeded Black Russian usually gives the highest yields per acre in this Colony, the common and large-seeded Russian coming next, and the white last.

Uses of the Crop. The seed is used largely as a food by the peasants of Russia. On crushing, the seed yields an oil of the drying type, which is used for lubricating and table purposes, for the making of the finer soaps and candle making. It is also used in woollen factories, for lighting purposes and in the manufacture of paints and varnishes. The residual meal obtained after the expression of the oil makes a valuable cattle cake.

The unhusked seed is largely used as a poultry and fancy bird food, the white and striped varieties being in the greatest demand for the latter purpose. When crushed and mixed with other feeds it forms a valuable ingredient of the rations for cattle, sheep and pigs.

The analysis of unhusked seed is approximately as follows:—

Dry matter	93.1 per cent.
Soluble carbohydrates	23.1 per cent.
Crude protein	18.5 per cent.
Crude fat	21.5 per cent.

The nutritive ratio of unhusked seed is 1 : 4.

The dry heads, still containing a few seeds after threshing, form a good stock feed if cut up or milled into small pieces and mixed with other foods, especially succulents.

The leaves when air-dried and cut into small pieces are valuable for mixing with the mash foods given to poultry during the dry season. The pith is also fed to poultry.

It is not generally known that sunflowers can be used for grazing and green soiling, and for these purposes they might be planted after an early reaped legume silage crop in February to provide autumn grazing or green forage.

The stalks, leaves and heads, after removal of the seeds, contain valuable amounts of phosphoric acid, potash and lime, and therefore all refuse from the crop should be collected and composted.

The following is the analysis of the ash of sunflower heads, stems and leaves made by the Chemistry Division of this Department:—

Sunflower Ash.

Phosphoric oxide	0.98 per cent.
Potash	28.90 per cent.
Lime	12.00 per cent.

The analysis of the leaves, and also of the de-seeded heads of the sunflower, for feeding purposes, are given below.

Analysis of Sunflower Leaves.

	Rhodesian Sample (as taken) per cent.	Air-dried (Rhodesian) per cent.	Air-dried (American) per cent.
Water	78.73	14.87	12.51
Ether extract (fat)	0.70	2.82	4.09
Protein	4.12	16.50	10.15
Carbohydrates	10.53	42.15	38.83
Crude fibre	1.97	7.87	13.16
Ash	3.95	15.79	21.26

It should be noted that this sample of Rhodesian-grown sunflower leaves was over 62 per cent. richer in protein and 47 per cent. lower in crude fibre and 31 per cent. lower in ether extract

(fat) than the American-grown product. These are important points to remember, as the digestibility of the protein, fat and carbohydrates of a food is adversely affected by an increase in the crude fibre present. The nutritive ratio of both the green and dry leaves is 1 : 2.9, lucerne being 1 : 3.2.

Analysis of Sunflower Heads after removal of Seeds.

	Rhodesian per cent.	American per cent.
Water	11.73	7.40
Ether extract (fat)	3.18	5.07
Protein	8.86	9.91
Carbohydrates	46.42	39.79
Crude fibre	18.19	18.44
Ash	11.62	19.39

The nutritive ratio of sunflower heads minus the seed is 1 : 6.04.

Sunflower Head Meal. A meal made by passing the sunflower heads, containing about 5 to 10 per cent. of ripe seeds, through a disintegrator is used for stock feeding, combined with other feeds, on the Government Farm, Gwebi.

An analysis of this meal has been made by the Chemical Division of the Department and is compared in the table below with that of wheat bran.

	Sunflower Head Meal per cent.	Wheat Bran per cent.
Moisture	14.00	13.2
Ash	9.90	5.9
Protein (N x 6.25)	8.84	14.3
Ether extract	5.86	4.2
Fibre	31.70	10.2
Carbohydrates	29.70	52.2

The comparative metabolisable energy and albuminoid ratio of sunflower head meal and wheat bran are as follows:—

	Metabolisable Energy.	Albuminoid Ratio.
Sunflower head meal	83.83	1 : 8.5
Wheat bran	85.96	1 : 5

The Chief Chemist makes the following remarks on the above analyses: "The above figures for the metabolisable energy and albuminoid ratio are calculated on the crude nutrients and not on digestible nutrients. As the fibre content of the sunflower head meal is considerably higher than that of wheat bran, it is highly probable that the difference in the metabolisable energy of the two materials is far greater than it appears from the figures calculated on the above basis."

Sunflower Ensilage. Sunflowers make excellent silage, nutritious and palatable, but care has to be exercised in the making of it. If used alone for this purpose, and if the plants are not sufficiently mature, the resulting silage may be too sour and unpalatable. On the other hand, if the crop is too ripe the lower parts of the stems become too dry, fibrous and unpalatable. The best sunflower silage produced at the Agricultural Experiment Station, Salisbury, was made from sunflowers on which the flower heads were well developed and the petals were beginning to wilt.

The sunflower plant is deficient in sugar content for silage making, and where they are ensiled alone about 2 per cent. by weight of molasses should be added at the pit. Alternatively, 2 parts of maize or wintersome may be mixed with 1 part of sunflowers to make up the deficiency and thus ensure the proper development of the lactic acid necessary to preserve the ensiled materials from decay. This is now the common practice among farmers who use this crop for ensiling and it can be recommended, since the mixture is more palatable than the molassed sunflower silage.

The following analyses of sunflower silage are given by Dr. Shutt, of the Canadian Department of Agriculture, and may be compared with that of maize:—

	Water.	Crude Protein.	Crude Fat.	Carbo-hydrates.	Fibre.	Ash.
Sunflower cut when 10 per cent in bloom	75.67	3.43	1.24	10.17	6.22	3.27
Sunflower seeds fully formed	52.31	5.06	2.42	24.75	10.16	5.30
Maize* planted 24 x 15 inches	75.47	2.08	0.43	14.55	5.50	1.95

It will be seen that the silage made from sunflowers, cut at approximately the same stage of growth as maize and with a similar moisture content, contains a higher percentage of crude protein, fat and ash than the latter.

Digestible Nutrients in Sunflower Silage as compared with Maize Silage.

In the following table, compiled from actual analyses made by the Division of Chemistry of the Department of Agriculture, South-

*Silage made at the Agricultural Experiment Station, and analysed by the Division of Chemistry, Department of Agriculture, S. Rhodesia.

ern Rhodesia, it has been assumed that each silage contains 25 per cent. of dry matter and has a similar degree of wetness.

	Dry Matter %	Digestible Nutrients Crude Protein %	Carbo-hydrates %	Fat %	Approx. Starch Equi-valent
Sunflower (outer flowers open, inner flowers not open)	25	2.3	10.5	0.9	12.2
Sunflower (top half of plant; seeds formed)	25	2.4	10.2	1.0	12.3
Sunflower and Maize (cobs milky stage)	25	1.7	11.9	0.7	12.5
Maize	25	1.0	13.6	0.6	13.3

These sunflower silages were richer in protein and fat but poorer in carbohydrates than maize silage, but the starch equivalent was lower than that of maize silage. Blackshaw (Bulletin 533 of Department of Agriculture, Southern Rhodesia) writes of sunflower silage as follows:—"The sunflower crop will produce a palatable silage when properly handled, but sunflower silage is considered generally to be less palatable than maize silage and to have a somewhat lower feeding value. This is borne out by comparing the starch equivalent factors for the two in the above table. The higher digestible crude protein content of sunflower silage should, however, give it an advantage over maize silage, if one or other had to be fed with foodstuffs of low protein content."

One most important point to be borne in mind as regards sunflower silage is that sunflowers can be grown successfully where the season is too short or the rainfall too light to produce a heavy maize crop. Furthermore, a farmer who requires a silage crop can give his land a beneficial change from maize by growing sunflowers or a mixture of sunflowers and velvet beans for this purpose.

The following results of experiments covering four seasons carried out at the Bulawayo Municipal Experiment Station illustrate the high yields obtained from sunflowers as compared with maize.

It must be pointed out, however, that owing to both velvet beans and sunflowers being deficient in sugar content, 2 per cent. by weight of molasses (40 lbs. per ton of green material) should be added to the mixture when ensiling it in order to render the silage palatable, and to prevent loss of food constituents due to decay. Alternatively, two wagon loads of maize can be thoroughly mixed with one load of the mixture into the pit.

This photograph illustrates the moisture retentiveness of the Kalahari sands, and the hardiness and drought-resistance of sunflowers. The total rainfall the crop received was one and a a half inches (1.5 inches). Germinated on the 29th March, 1941, it was photographed on 16th August, 1941. They followed a poor silage crop of Pearl Millet reaped in March, 1941.

A crop of sunflowers grown on 6.37 ins. of rain.

	1925-26.	1922-25.	Average Yield.
Sunflower and velvet beans, same row, 36 in. x 18 in.	12,400	18,773	17,179
Sunflower and velvet beans, alternate rows, 20 in. x 18 in.	—	16,339 (2 seasons)	16,339
Sunflower alone, 30 in. x 12 in.	16,848	24,532 (1924-25)	20,690 (2 seasons of good rains)
Maize and velvet beans, same row, 36 in. x 18 in.	5,952	13,323	11,480
Maize alone	11,104	14,175	13,407

For purposes of comparison, the results of trials with maize and velvet beans grown together and maize alone are given.

It will be seen that sunflower and velvet beans grown together and sunflower alone have given consistently greater yields of green fodder than maize and velvet beans or maize alone.

It should be noted that the soil on the plots on which these trials have been carried out is very shallow, at no place having greater depth than 8 inches before the gravelly or rocky sub-soil is reached. These results indicate the high yielding power of the sunflower crop in the drier climatic conditions of Matabeleland.

On the Agricultural Experiment Station on Rhodes Matopos Estate sunflowers consistently outyielded maize as a silage crop.*

When silage making with other crops is being carried out at the time of harvesting sunflowers for seed, the empty flower heads as well as the upper part of the stalks may be mixed in with the other crops. If the heads are dry, they should be sprinkled with a little water, unless the other crops contain sufficient moisture to balance the lack of it in the sunflower heads. In this way the sunflower crop is utilised to its fullest extent.

A silage mixture recommended in some parts of the United States is composed of the produce of one acre of sunflowers (heads only being used) with that from four acres of maize, and this may be further improved by the addition of one acre of legumes, such as velvet beans, dolichos beans, cowpeas, etc. Generally it has been found in Southern Rhodesia that sunflower silage alone is rather too sour to be palatable to stock, and it has generally been found advisable to mix sunflower with other crops (maize or wintersome) in the silo. Fed in this way it is a valuable addition to the succulent feeds available during the dry season, and narrows down the nutritive ratio of the succulent feeds.

Sunflowers in Rotation. The sunflower is a very useful crop in mixed farming, and its cultivation might be greatly extended in this country with advantage, especially in districts of light rainfall.

*Unpublished data supplied by the Chief Animal Husbandry Officer.

In rotation with maize it has been found to be an excellent change crop. In other parts of the world it is looked upon as being an exhausting crop, but in Rhodesia the general opinion, borne out by experience, is that this is not so. It has been shown in Rhodesia to be certainly less exhausting than either buckwheat or linseed.

The following experiments carried out at the Salisbury Experiment Station indicate that sunflower is a very suitable change crop with maize, and certainly not an exhausting one, especially if, after harvesting, the stalk refuse is burnt and the ash broadcast and ploughed under.

Maize Yield in Bags per Acre.

System of Cropping	1923-24	1922-23	1921-22	1920-21	Average
Maize continuous	12.4	11.9	8.75	23.00	14.01
Maize alternating with sunflower	13.5	15.3	10.75	22.25	15.31

N.B.—This land at the time these trials were carried out had never received manure.

In a rotation it is useful too as a cleaning crop, as the dense shade thrown by the foliage tends to inhibit the growth of weeds as soon as rapid growth commences when it reaches a height of 18 to 24 inches.

The value of sunflowers in a rotation in comparison with that of ground nuts was under investigation from 1928 to 1943 at the Salisbury Experiment Station.* The sequence of the rotation was green manure; maize, plus 200 lbs. per acre of superphosphate; ground nuts and sunflower; maize, plus 200 lbs. per acre of rock phosphate.

The average yields of the second maize crop for a period of 14 years was 10.65 bags per acre following ground nuts, and 10.17 bags per acre following sunflowers. This is additional and more convincing evidence that sunflowers are not an exhausting crop on the heavy soils of the maize belt; and the widespread experience of practical farmers confirms this. During the 15 year period the sunflowers yielded a total of 16,300 lbs. of seed per acre, and the ground nuts 14,489 lbs. of nuts in the shell.

Effect on a Following Ground Nut Crop. An experiment covering three seasons (1935, 1937 and 1938) was carried out at the Salisbury Experiment Station† to investigate the effect of six different crops on the yields of the ground nut crop following them. The six crops were sunflowers (grain), oats (hay), sunn hemp (grain), maize (grain), velvet beans (grain), and sunn hemp (ploughed under). Taking the yield of ground nuts following sunn hemp (ploughed under) as 100, the yields following the other crops were, respectively (in the above order): 120.7; 113.4; 112.3; 109.4;

* Annual Report, Salisbury Experiment Station, 1942-43.

† Annual Report, Salisbury Experiment Station, 1937-38.

108.2. Statistical analysis of the results showed that in the increased yields of nuts following sunflowers, oats, and sunn hemp (grain) are significantly greater than those following sunn hemp (ploughed under). No explanation can be offered as to why sunflowers were so favourable to the ground nut crop, but their superiority over the other crops was clear in each of the three seasons.

Sunflowers as a Source of Honey. Where bees are kept for profit, the large flower heads of the sunflower are most important as a source of honey. No plant produces finer honey and wax.

Use as a Green Manure Crop. Sunflowers are a valuable green manure crop, and are of particular value on dirty land, since it is a more effective weed-smothering crop than any other green manure grown in this Colony, owing to the dense shade thrown when broadcasted at a suitable rate of seeding, namely, 45 to 55 lbs. per acre.

Their manurial value, as measured by a following maize crop, is rather higher than that of a sunn hemp crop that is sown late to avoid attack by beetles, but about 9 per cent. lower than an early sown sunn hemp crop, as indicated by the results of experiments on soils of the heavy red Salisbury series.

They must be sown in the latter half of December in order to avoid the ripening of the seed prior to ploughing down, which would necessitate the killing of the dense self-sown crop of sunflowers in the following season that would, of course, delay the planting of a following crop of maize.

A further disadvantage that must be borne in mind is that the crop is very susceptible to attack by eel worms and cannot therefore be safely grown in rotation with crops such as potatoes and tobacco, that are also very susceptible to this serious pest.

The crop is easily ploughed under by the common types of three-furrow disc-plough.

A mixed seeding of 30 to 35 lbs. of sunflower seed with 20 to 25 lbs. of upright cowpeas is also suitable for green manuring, and can be expected to secure rather heavier yields from a following maize crop than sunflowers alone, owing to the presence of the legume. The seeds can be sown together, but should be kept well stirred to ensure an even mixture of the two crops.

The deep rooting of these two crops is helpful where a plough pan has formed, and in such cases this mixture would be preferable to sunn hemp or velvet beans.

Where a farm is not infested with the sunn hemp beetles, a mixture of 30 to 35 lbs. of sunflower seed with 20 to 25 lbs. of sunn hemp is a satisfactory green manure crop, and can be expected to have the same manurial value for a following maize crop as the sunflower/cowpeas mixture.

Climate and Soil Requirements. The soil requirements of the sunflower are very much the same as those of maize, though it may be grown successfully on soils too poor to give a good yield of maize. It will often give a good return on old maize lands which will no longer return a paying crop of maize. Generally speaking, maize is a more profitable crop to produce than sunflowers in this

Colony wherever the yields in bags per acre are about equal, as the price of maize per bag is usually higher than that of sunflowers. However, on the poorer sandy soils and in areas where the rainfall is deficient for maize, sunflowers may often give a better return.

The sunflower will grow on all classes of soils from heavy clays to poor sands, but will give the best yield on those soils well suited to maize. The sunflower is more adaptable as regards its climatic requirements than maize, and can be grown as far north as lat. 74 degrees in Norway; yet it will grow in the excessive summer heat of Central Australia better than most crops yet tried there.

The fact that the sunflower is considerably more drought-resistant than maize is probably due to the fact that it has a long, strong tap root, whereas the maize plant has none, and that the plant also has a stronger fibrous root development than maize.

Manuring. As will be seen from the following analysis (Chemical Division of the Department) of the plant after removal of the seeds, the crop takes considerable quantities of lime and potash from the soil, and it is therefore advisable to compost such refuse as there may be after harvesting and threshing, and to spread the compost on the fields, or to feed this refuse to stock and return the manure to the land.

Analysis of Ash.

Phosphoric oxide	0.98 per cent.
Potash	28.90 per cent.
Lime	12.00 per cent.

Unleached wood ash for the same reason is a valuable fertiliser for sunflowers on sandy soils, and where the labour involved is not too expensive may be applied at the rate of from a half to two tons per acre. This treatment, combined with a green manure crop, gives excellent results. Well-rotted farmyard manure or compost is the best fertilising agent for sunflowers, except on the more fertile soils or soils containing much humus. On such land and if heavily manured, the plant is liable to produce a number of lateral branches, which are undesirable; and the yield of seed is apt to be reduced owing to excessive vegetative growth. Generally, however, with normal prices for the seed obtaining, it is not economic to fertilise the crop directly, and it is usual to manure or fertilise the preceding crop. Sunflowers, therefore, are usually best grown in a rotation with other major crops, such as maize.

When sunflowers are grown as a major crop for seed or silage, it should be profitable to give the land a dressing of about 200 lbs. of superphosphate or bone and superphosphate per acre. This will promote root development and seed formation. Generally, however, manures or fertilisers are applied to a previous cash crop.

Preparation of the Land. Good preparation of the land for sunflowers is often neglected, since in this respect the crop is not so exacting in its requirements as most others. However, good and thorough methods of cultivation will pay with this as with other crops. The working of the land is essentially similar to that re-

quired for maize. Good ploughing and proper preparation of the seed-bed so as to obtain a fine, even tilth are most important if the best results are aimed at. It is of importance that the soil should be turned to as great a depth as possible up to 9 inches, having proper regard, of course, to the danger of turning up the sub-soil, and also to the cost of the operation.

After ploughing, the land should be disced or drag-harrowed sufficiently to keep the weeds under control, and particularly just before planting. Thus, when the crop is high enough to cultivate, the weeds will still be small enough to be killed easily.

Planting. The seed is best planted at a time which ensures that the crop is ready for harvesting after the rains and before the frosts. As a rule sunflowers may be planted later than maize, as they mature more quickly, being ready for harvest some weeks before maize planted at the same time.

Sunflower seed should be drilled in rows about 3 ft. to $3\frac{1}{2}$ ft. apart by means of a maize planter. About 8 to 10 lbs. of seed per acre are required. The seed should be planted in moist soil if possible, at a depth varying between 1 in. on heavy, wet soils to $2\frac{1}{2}$ ins. on the lighter sandy soils. Thinning should be done when the plants are about 6 ins. high, so that the plants stand about 12 to 15 ins. apart in the row.

The width between the rows should be varied between the limits given above according to the rainfall and the fertility of the soil; a poor soil with a low rainfall requiring a wider spacing. Where sunflowers are grown for silage they should be thinned out to only about 8 to 10 ins. apart in the rows so as to avoid coarseness of the stems.

The green manure crop that is broadcasted at the rate of 45 to 55 lbs. per acre may be covered by disc harrow or spring-tooth harrow.

Cultivation of the Crop. Cultivation should be carried out often enough to keep the weeds under control until the plants have attained a height of about $1\frac{1}{2}$ to 2 ft., when the shade thrown by the crop is usually sufficient to discourage further weed growth. During the first two to three weeks of their life the growth of the seedlings is slow. If after heavy rains a crust forms on the soil surface, it should be broken up by cultivation to render the soil again receptive of moisture.

Any suitable type of maize cultivator can be used. While the plants are small and before the roots have spread across the space between the rows, deep cultivation may be carried out with beneficial results, but after this stage shallow cultivation to a depth of not more than 3 ins. and preferably only 2 ins. should be given. If the cultivators go deeper, the lateral roots will be broken and more harm than good may be done. It may also be necessary to hand hoe the weeds from between the plants in the row.

Harvesting. The crop matures in four to five months according to the conditions of the season and soil, and the height above sea level.

The seed heads should be harvested before they are quite ripe to avoid loss of seed by shedding. As the crop usually matures unevenly, it may be necessary to go through it two or three times.

The heads are cut off by hand with a sickle or other suitable implement, and are usually laid face up on the ground between the rows for a few days to dry. One native can cut a half to three-quarters of an acre a day, including the cutting of the stems at ground level. During rainless weather the heads may be safely piled three or more deep, but if rain falls whilst the heads are drying there is danger of them becoming mouldy or fermenting. However, as harvesting is usually done after the rains have ceased, this difficulty seldom arises.

As the heads dry out the seeds become loosened, and the heads are therefore usually bagged as soon as they are dry enough and carted to a threshing floor, where the seed is beaten out with sticks. An alternative method of threshing is to rub out the seed on fine-meshed wire netting stretched suitably on a wooden frame.

The seed should be spread out in a thin layer and turned over occasionally until it is thoroughly dry and then bagged. It should also be winnowed to remove the empty husks and rubbish, particularly if the seed is intended for sale or export. From an average crop one native can gather and bag about 40 or 50 sacks of heads a day.

Combine Harvesting. During the late war the cultivation of sunflowers as an oil crop was carefully investigated in England* with success, yields of up to 20 cwt. of seed per acre being obtained in the fifth year of trial (1945). But in order to economise labour, new methods of harvesting had to be employed, and it was found that by close-spacing (18 by 9 inches) of certain dwarf varieties of sunflowers the crop could be successfully harvested by several of the combine harvester-threshers. Certain modifications to these "combines" were necessary in each case, but it was nevertheless demonstrated that combine harvesting of the crop was quite feasible although the climatic conditions were far from favourable for this system of harvesting the crop as compared with the very dry conditions obtaining in this Colony during April and May, when the crop normally ripens here.

It remains to be seen, however, whether the dwarf varieties successful in England will be suitable for our local conditions. In the past the dwarf varieties tested have not yielded nearly so heavily as the tall varieties at present grown. If a dwarf variety of suitable yielding ability can be found, combine harvesting might lead to a considerable extension of the area under this crop in Southern Rhodesia, since our climatic conditions are admirably suited to it. And if the oil was expressed in the Colony the residual cake would be of great value to the livestock industry, since its feeding value equals that of linseed and cotton seed cake.

Selection of Seed. The use of good pure seed for planting is of the first importance with the sunflower crop as with any other crop, both from the point of view of obtaining the highest yield per acre, and also to ensure a pure sample when the seed is marketed.

Sunflowers cross-fertilise freely, and as this leads inevitably to deterioration in the progeny, care should be taken, if two varieties are grown on the farm, that they are planted as far apart as pos-

* By G. E. Blackman, working under the auspices of the Agricultural Research Council.

sible. It is better practice to grow only one variety and so ensure that there is no cross-fertilisation.

Only those heads should be selected which are above the average in size and which bear seeds which are heavy and well filled by the kernel. It is useless to select plants which are growing under abnormal conditions, such as in a thin stand of plants or on a particularly fertile patch of soil, as these probably owe their greater size to the soil conditions, and not to any hereditary character. Plants that branch freely should always be discarded, as this is an undesirable characteristic, as it increases the labour of reaping, reduces the yield and causes inequality in the size of the seed. Heads that shed their seed too freely should also be avoided. Care should be taken to select plants which produce a large number of leaves.

Yield. An average yield of sunflower seed under normal good conditions in Rhodesia may be taken to be 10 to 12 bags an acre, but with good farming and on fertile soils from 15 up to even 25 bags may be obtained. The highest yield recorded at the Agricultural Experiment Station, Salisbury, on land of no great fertility was obtained in the season 1920-21, when 17.5 bags per acre were reaped on a rainfall of 33.4 ins. In the season 1922-23, with a rainfall of 42.6 ins., the yield was 11.0 bags per acre, and in the season 1921-22, with an effective rainfall of only about 10 ins., the yield was 7.2 bags per acre. From this it may be seen that, to give the best yields of seed, sunflower, like maize, prefers a normal season rather than a very wet one, but that good returns are obtainable even in a drought year.

It should be noted that the above yields were obtained on unmanured and unfertilised land. Results comparable to those given above have been obtained at the Bulawayo Municipal Experiment Station, as is shown in the following table of results:—

Year	Yield per acre in lbs.	Effective Rainfall
1922-23	1,170	32.57 ins.
1923-24	889	13.30 ins.
1924-25	1,132	45.07 ins.
1925-26	908	20.00 ins.

It may be seen that even in a drought year sunflowers gave a good return, namely, 7.1 bags per acre of seed (125 lb. per bag).

Pests and Diseases. The sunflower plant is comparatively free from diseases and insect pests in Rhodesia, and weevils have not been found to damage the seed when stored. It is, however, very susceptible to attack by eelworms, which makes it unsuitable for tobacco and potato rotations.

Sunflower Seed for Export. In August, 1926, export regulations were introduced in Rhodesia to control the export of sunflower seed.

These regulations were introduced with the object of giving prospective buyers overseas confidence that they will receive from the producers in this country sunflower seed of a definite quality and grade as described in the certificate. This reacts to the farmer's advantage in that the buyer can quote for a definite grade, thus removing the risk the farmer runs in sending an unclassified product to a market outside this Colony, the value of which on that market cannot be known until it arrives there. Without Government grading the exporter would be compelled to sell his sunflower seed in this manner, or "on sample," with all the delay consequent on this latter method of sale.

All sunflower seed intended for export must be examined by a Government Grain Inspector, who takes a sample from each bag and assigns it to one of the five grades laid down in the regulations, which are as follows:—

Grade I, Black. To be sound, dry, reasonably clean and to contain not more than 3 per cent. of off-colour and/or defective seed and/or other impurities, and to weigh not less than 27 lbs. per bushel. Seeds may be of irregular size and shape.

Grade II, White. To be sound, dry, reasonably clean and to contain not more than 3 per cent. of off-colour and/or defective seed and/or other impurities, and to weigh not less than 27 lbs. per bushel. Seeds may be of irregular size and shape.

Grade III, Striped. To be sound, dry, reasonably clean and to contain not more than 3 per cent. of off-colour and/or defective seed and/or other impurities, and to weigh not less than 27 lbs. per bushel. Seeds may be of irregular size and shape.

Grade IV, Mixed. To be a mixture of any of the above-mentioned varieties, including dark and/or grey, or striped seeds; to be sound, dry, reasonably clean and to contain not more than 3 per cent. of off-colour and/or defective seed and/or other impurities, and to weigh not less than 27 lbs. per bushel. Seeds may be of irregular size and shape.

Grade V, Undergrade. To comprise such sunflower seed as cannot be classed in any of the above-mentioned grades, but to be in sound condition and reasonably clean and to contain not more than 10 per cent. of defective seeds and/or other impurities. Seeds may be of irregular size and shape.

Any seed found on examination to be damp, wet, unripe, musty, weevilly or to be affected by other insects will be rejected by the inspector. Sunflower seed for export may not contain more than 12 per cent. of moisture. A minimum net weight of seed must be

contained in each bag of 100 lbs., and the bags must be in good, sound condition, free of holes and/or patches, and must be double sewn at the mouth.

Bagged sunflower seed for export, as in the case of maize for export, must be stacked in tiers seven bags high and two deep, allowing 3 ft. 6 ins. between the double rows of tiers. If the double rows are closer together, the inspector is unable to do the work of testing and marking satisfactorily.

The farmer should not remain content merely to produce a good yield of sunflower seed. He cannot foresee when he may require to sell for export, and he should ensure that his seed is marketed in a condition acceptable to the buyer and in a state which, if the need arises, will enable it to contend with the keen competition of producers in other countries.

Care should therefore be taken by the farmer to select his seed carefully each season, or to buy only seed of a guaranteed purity. He should also take steps to see that the heads do not become mouldy while drying out on the land or in the dump, and to ensure that the seed is thoroughly dry before bagging. The crop should be carefully winnowed to remove light seed and extraneous rubbish.

The best price for the product will generally be secured by growing a pure strain of one variety only, since the overseas buyer usually requires one type or the other, and not a mixed sample.

Farming Calendar.

(Continued)

MARCH.

GENERAL CROPS.

Read Bulletin No. 1337 on when to plough in green manure. Plough under witchweed traps in time. Watch oats for rust, and if badly infested cut crop for hay as soon as weather permits. Ridge late potatoes and if weather is dry prevent ridges from cracking to check tuber moth infestation. Cut silage crops and ensile. Cut out barren maize plants and ensile or feed to stock. Cut Sudan grass for hay to permit of final late growth for autumn grazing. Reap any crops that are ready and plough the stubble. Watch for groundnuts making second growth if rain falls after they are mature; reap, and when sufficiently dry, place in cocks with nuts inwards, and cover the top securely. Continue to plough all lands in succession immediately the crops are reaped. Vleis or irrigated lands should now be ready, or in process of being prepared for winter crops. Early sowings of winter oats, barley, or rye for green forage can be made. Allow any potatoes lifted to dry before storing them, but do not leave too long in the sun. Destroy witchweed and other noxious weeds. Continue to make all the kraal compost possible by throwing grass and litter into kraals, yards, etc. Begin to select in the fields maize plants for seed purposes, and mark them with slips of coloured cloth. Press on with the breaking up of any virgin land which may have been stumped or cleared earlier in the year. Place orders for grain bags and fertilizers without delay. Early in the month silage pits should be cleaned out or new pits dug. Put in oats for green soiling, so that you can rest your lucerne during the cold months when cutting greatly weakens the latter.

TOBACCO

All late plants should be topped low to hasten maturity. The bales of cured leaf should be examined to ascertain whether or not the tobacco has been baled in proper condition. Seed heads should receive continued care. Land ploughed during February should be disced and rolled to assist the decomposition of organic matter. Tobacco fields already cleared of plants should be immediately ploughed. Tobacco bulks should be examined and turned if necessary.

Turkish Type. Final selection of seed plants should be made during this month and harvesting of crops should start when the first flowers begin to open.

FORESTRY.

Cultivation where necessary may be undertaken between the rows of trees planted out the previous months. If cultivation is carried out with the hoe, care should be taken not to pile earth round the base of the stems. New ground for next season's planting should be roughly broken up with the plough. Bulk plantings may be proceeded with during the month.

CITRUS FRUITS.

Two thorough sprayings with Alboleum or Harbas about this season, when the rains are usually practically over, at an interval of about two weeks, will often obviate the necessity for further work against scale insects until the beginning of the next season. If not already done, orchards should be ploughed and cross-ploughed and worked up into a really good surface, so that the cultivators can be kept going, say, every two weeks until it is necessary to irrigate, after which cultivation should be continued. If March proves a dry month, orange trees holding a crop of fruit will probably require irrigation, but under normal weather conditions it should not be necessary. About the end of this month fall budding can be taken in hand—that is, the insertion of buds that are intended to remain dormant until spring. This applies to higher altitudes, but in low country, where the growing season is extended, dormant budding should not be done until the latter end of April.

DECIDUOUS FRUITS.

Prop up branches of trees heavily laden with fruit.

VEGETABLE GARDEN.

The sowing calendar is the same as that recommended for last month. Plant out from seed-beds cabbage and cauliflower; care should be taken during this month, as the end of the rainy season approaches, to dig with a fork all the ground in the garden. The heavy rains settle this down hard, and as soon as the dry weather begins the soil cracks and lets out all the sub-soil moisture by evaporation. As soon as the rains cease entirely it is advisable to go over the ground and fine down with a rake, leaving some three or four inches of quite fine soil to act as an earth mulch.

FLOWER GARDEN.

Flower seedlings for winter blooming should now be coming on, and should be planted out during showery or cloudy weather. Cuttings of carnations may now be made, and should be taken from selected plants which have borne the choicest blooms. The cuttings should be dibbled in half paraffin tins containing three parts sand to one of loam, and kept in a moist condition in a shady position sheltered from the winds, or beds made in shelter in the open ground. Make main sowing of winter-flowering sweet peas in a well-prepared and rich soil.

INSECT PESTS.

Maize. During March the second brood of stalk borers will be getting from the leaves or cups into the stalks. This will more or less mark the end of any opportunity to prevent further damage to the present crop. The only other opportunity would be the prevention of migration from overcrowded plants. In general, however, the first or early brood of borers is the more important, as the plants are then smaller and more seriously affected. Anything that can be done to suppress the first brood early in the season is thus of considerable value. Therefore, if a badly infested land is judged in March or April to be of equal value whether used for ensilage or used to produce grain, it would be preferable to use it as ensilage in order to prevent the borers from overwintering and producing moths which can give rise to the first generation of borers in the following crop. See January "Insect Pests" remarks on ensilage and trap crops for the second generation of stalk borers.

Caterpillars of various kinds sometimes attack the maize crop as a sequel to cultivation of grass weeds which have made too much growth. The caterpillars attack the crop on account of their more natural food having been suddenly destroyed. Prevention and not cure is indicated.

Tobacco. The crop will by this time mostly have outgrown susceptibility to serious damage by insect attack, but leaf miners and budworms may be in evidence. The latter are normally destroyed by hand when topping, or when examining bagged seed heads.

Potato. The maintenance of ridges continues to be the most important factor in controlling tuber moth. With the cessation of the rains and the drying up of potato stems, cracks are apt to develop in the soil and holes are likely to be left by the shrivelling of the stems. These should be filled by keeping the surface soil loose in order to prevent tuber moth from gaining access to the tubers. In many cases the soil is to be the storage place for the tubers for some months, and it should be remembered that tuber moth is a pest of stored potatoes as well as of the field crop, and needs to be countered throughout the year.

Growers who are considering the production of a winter crop of potatoes as well as a summer one should weigh carefully the fact that the continued growing of a particular crop throughout the year can have the effect of perpetuating and increasing some or all of its insect pest species.

Orchard. Citrus trees should be watched for the development of black citrus aphis and soft brown scale on the young growth. These pests are the indirect cause of the development of sooty mould on the foliage and branches. Applications of resin wash or oil sprays will control them. If aphis, only, is present, sprays of tobacco extract or tobacco wash can be used instead.

Collect and destroy infested citrus fruit to help in the control of false codling moth (citrus codling moth) and fruit flies. A suitable fruit fly bait spray for application to citrus trees when required can be made by dissolving 1 to $1\frac{1}{4}$ ozs. of sodium fluosilicate, and then 2 lbs. of white sugar, in 4 gallons of water. The bait is

applied, preferably through a rose type of nozzle or sprinkler, lightly over the trees so that drops of it will fall on the leaves, where they can be readily found and fed upon by the adult flies. A garden syringe is a useful appliance, one or two syringefuls being used for each average tree. Bait should be applied about weekly, and also when the foliage has dried after a washing rain.

Garden. Recommendations for previous months, mostly referring to plants of the cabbage family, continue to apply. For convenience, some are repeated here:—

Greenfly or aphis on cabbage may sometimes be kept under control by repeatedly dislodging them by means of a powerful spray of water directed at the under sides of the leaves and in the crowns of young plants. Good garden-hose pressure is sufficient. A surer method is the use of tobacco extract sprays as recommended by the manufacturers. Do not "put in a little extra" when the pest is severe on well-grown plants, because in these circumstances certain parasites are present in large numbers and may be killed by too concentrated a spray, although not affected by spray of normal strength. Spraying should nevertheless be thorough.

Webworms and other caterpillars attacking young cabbage and similar plants, and the caterpillar-like larvae of the turnip sawfly, may be controlled by dusting, as necessary, with a mixture of 1 lb. Paris green and 20 lbs. finely sifted hydrated lime or flour, or 1 lb. lead arsenate powder to 4 parts fine lime, or with D.D.T. powder. A manufacturer recommends "Agrocide No. 3" (containing benzene hexachloride) for winter use against cabbage pests, including Bagrada bug. Dusts should be applied by means of dusting-bellows or a dust gun, or, under large-scale conditions, by appropriate dusting equipment. Spraying with 1 lb. lead arsenate in 30 gallons water, plus spreader, can be substituted for dusting, but it is often difficult to obtain an even deposit on cabbage leaves. Flea-beetles attacking turnip leaves can be controlled in the same way.

Leaves which are to be eaten should not be harvested with a coating of poison on them. Stop spraying them with poison a few weeks before plants such as cabbage are to be ready. Derris and similar insecticides can be substituted during this period if necessary.

Bagrada bugs may appear as early as March and continue throughout the dry season. Cleanliness, disposal of refuse of plants of the cabbage family and other cultural methods aid in their control. Three more recently advised chemical methods against them are a dilute methylated spirit-soft-soap solution, D.D.T., and benzene hexachloride. Write to the Chief Entomologist for particulars. In the flower garden, stocks, alyssum and nasturtium are among the plants attacked by Bagrada bug.

The fruit of cucumber, squash, and other plants of its family are liable to attack by cucurbit flies, close relatives of the fruit flies. These may be kept under control by the destruction of infested fruits and the use of one of the two fruit fly baits described in this month's and May's "Insect Pests" notes, respectively. (See also October.)

In general, insects chewing the leaves of garden plants are killed by standard residual stomach poisons such as Paris green or lead arsenate, or the less soluble of the fluorine compounds, or by the more modern insecticides; aphids are controlled by tobacco extract. Precautions should always be taken against the danger of humans or stock consuming poisoned foliage or fruit or the concentrated poison itself.

In most agricultural pursuits, remember:—

"Cleanliness Aids Insect Control"

PLANT PATHOLOGY.

Treat tobacco as for February. If heavy rains fall keep sharp look-out for *Alternaria* and angular spot and reap early. Spray with nicotine extract, if aphids appear, to destroy these pests, which carry rosette disease. Clear reaped lands of old stalks wherever possible for the same reason.

Spray potatoes with copper fungicides to protect from blight.

Roses now become very susceptible to mildew and black spot. Dust with sulphur and, if necessary, spray with lime-sulphur (1—100).

Spray violet beds with copper fungicide to prevent development of unsightly leaf spot. Give same treatment to many flowering plants which are susceptible. Treat sweet pea seed with disinfectant dust before sowing and water young plants with Cheshunt compound weekly to prevent stem rot in hot weather.

Sow seed of winter plants and dust surface of soil with Bordeaux powder finally to prevent damping off.

Treat seed of peas, broad-beans, cabbages, cauliflowers, turnips and other crucifers, celery, spinach and other winter vegetables with disinfectant dust. Spray cabbages and cauliflowers with arsenate of lead and nicotine extract to destroy aphids, which carry serious virus diseases. Commence on young seedlings and repeat weekly.

Select only healthy runners for planting of strawberries. Destroy all plants with virus symptoms.

BOTANY.

Many grasses and plants, such as weeds or plants about which the farmer requires information, will be flowering. If an idea of their value is desired, it is first necessary to find out their botanical name. This can be done by sending specimens to the Government Botanist, P.O. Box 387, Salisbury. If parcels are marked "O.H.M.S., Plant Specimens," they may be sent post free.

Flowering and/or fruiting material is required, and it is best to send two or three specimens of each.

In the case of grasses it is usually essential to have the base of the plant cut at ground level or just below, for accurate determination. If the specimens are pressed between half sheets of newspaper and then rolled into a cylindrical parcel they will reach the department in suitable condition. Loose specimens in a box or other container are often unrecognisable on arrival.

PASTURES.

If weather conditions permit, March is one of the best months for hay-making; a heavy cut can be obtained, and the quality of the grass is still good. Special care should, of course, be taken to protect the hay from rain by baling and storing under cover or in well-made stacks.

During wet spells farmers are advised to make grass ensilage in preference to hay. Grass silage, if well made, is more palatable than hay made of the same grass and losses in nutrients are not so great. Planted pastures of high-yielding species, such as Napier Fodder, Rhodes Grass, Kazangula Setaria and Rhodesian Sudan are particularly suitable for this purpose.

Vlei pastures, and particularly improved vleiland, should be mown to improve the quality and palatability of the grazing in the autumn months.

March is also a good month to plan the next year's pasture planting programme, as the seed-bed preparation and the provision of seed or planting material should be planned well ahead.

CONSERVATION.

1. Construct new contours in green crops (as these crops have to be ploughed in anyway) while labour is available, oxen in good condition, and the ground soft.

2. Rebuild old contours in green crops.

3. Maintain and clean out irrigation furrows, in preparation for winter crops.

LIVESTOCK.

Beef Cattle. Much the same as during February. Calving should be finished, and in the drier parts of the Colony the bulls should have been put with the cows towards the end of the previous month or beginning of this month. Make sure that the bulls are in good, hard working condition, and feed any that may require assistance. All old females should be kept away from the bulls. This will ensure that they will not be in calf next season and be in good condition for slaughter. Cows with calves should continue to receive the very best attention. Castration and de-horning should not be neglected, and animals in the hospital herd should be seen daily. Quarter evil inoculation should be attended to in consultation with the Veterinary Department.

Dairy Cattle. With the grass getting rank and of low feeding value, dairymen should watch production carefully and feed sufficient good concentrates to maintain production. Experience has shown that it is very expensive and usually impossible to get cows back to a high level of production once they have been allowed to go down considerably.

The dairy ranchers will be wise to discontinue milking cows with calves early and leave all the milk for the youngsters. This will, of course, not be necessary if ample provision has been made to feed both the cows and calves. This can be done economically by producing green roughage crops for late grazing and/or feeding.

Late planted sunflowers, maize, velvet beans, cow peas, munga (inyouti), are all excellent for this purpose. They will enable the dairyman to stretch his summer and continue to produce milk at low cost and mainly on roughage feeds. Grazing on hay land aftermath should also be reserved for the cows being milked.

Calves and young stock should, of course, continue to receive good treatment. Their future depends to a large extent on how they are being reared.

Sheep. These should be in good condition unless the previous two months were abnormally wet. In the drier parts lambing will be in progress and in the higher rainfall areas it will be due to commence towards the end of the month. Handle the in-lamb ewes carefully and dose carefully according to Veterinary instructions. Keep all sheep away from vleis and other wet places.

Pigs. With lots of separated milk and green food available all pigs should be looking very well. Be sure to cull sows that do not produce and wean large litters of thrifty pigs. The herd average should not be less than eight good piglets weaned.

DAIRYING.

These are usually the most favourable months for dairy operations. Cooler nights are now in evidence, and there is usually little difficulty in maintaining low temperatures in the dairy. If elementary precautions are taken, all cream delivered to the creamery should be first grade.

The need for high-testing cream is not so important as during the summer months. Provided the cream is despatched to the creamery three times a week, the test may be dropped to 40%.

The need for cleanliness in all dairy operations is equally important during the cooler months as during the hot period. Regular sterilisation of all dairy equipment after use should be a regular daily routine.

Immediate cooling after separation should be aimed at during all seasons of the year. Organisms, those both harmful and beneficial to cream production and ripening require warmth for growth and reproduction. Deprived of this, they are unable to produce undesirable fermentations and the ripening process is left in the hands of the creamery operator where it belongs.

VETERINARY.

Horsesickness and Bluetongue may increase. If dipping of cattle has been systematically carried out, tick-borne diseases should be decreasing, but if dipping has been neglected they will continue and even increase.

POULTRY.

The most important work on the commercial breeding plants is the selection of the breeding stock for the coming season. No time should be lost in giving this work careful consideration, and advantage should be taken of every opportunity to make the best possible selection. Careful selection for constitutional qualities, breed characteristics, and on the production records, both males and females, is what is required.

Healthy pure-bred stock are capable of transmitting their good and bad qualities to their offspring. The longer a strain has been carefully selected for desirable characteristics, the greater the tendency will be for the progeny of that strain to inherit the good qualities of their ancestry, whether it be uniformity in size and shape of eggs and texture of the egg shells, or productivity and longevity.

In the selection of breeding stock individual birds must be considered on their merits and the merits of their ancestors; there are good, bad, and mediocre stock in all strains. The chief factors to have in mind are vigour, constitution, productivity, and reproductive qualities, purity of strain or pedigree and breed characteristics. Individual birds failing in vigour, constitutional and breed characteristics are not advisable as breeders, however attractive their pedigree might be. Poultry breeders should familiarise themselves with the "standard of perfection" for the breed in which they might be interested, also the principles involved in the selection of good stock, thus to establish our commercial breeds on a sound utility basis. Birds with standard defects should be rejected and not considered for the breeding pens.

There are five essential steps in the yearly cycle of keeping a complete breeding record which will furnish the information required. These are:—

1. The recording of each pair of birds.
2. Keeping a record of each breeding male's pedigree and progeny.
3. Making a record of each breeding female's pedigree, production and progeny.
4. Marking each egg of each of the breeding females as it is laid and pedigree hatching it.
5. Marking and recording the chicks at hatching in such a way as to identify them with their parents.

The incubators should be thoroughly overhauled, cleaned and fumigated; all the brooding equipment and trap-nests should be repaired and in good working order before they are required for the new season's operations. Leg-bands and wing-bands are required in good time for identification purposes. It is essential for those who purchase day-old chicks to have the brooding equipment ready before the arrival of the chicks.

FUMIGATION OF INCUBATORS.

1. **Forced Draught Machines.** Take 20 c.c. of formalin for every 100 cu. ft. of interior space; immerse a piece of cheese cloth of sufficient size for absorption of the formalin without dripping. The soaked cloth is placed in a direct line of the air current, which in fan-forced draught incubators will be close to and directly under the fans, or in front of the air inlet. Close door, and run at normal operating temperature with as high a humidity as possible. Amount of formalin can be varied from 16 c.c. to 25 c.c. for every 100 cu. ft.; with this concentration no harmful effects would occur with eggs

in the machine—the fumigation of eggs after the 18th day of incubation might be dangerous. In the case of empty machines, stronger concentration of formalin may be used to advantage.

2. **Small Machines.** Wet interior, and insert an enamel cup under the egg trays containing permanganate crystals with double the proportion of commercial formalin poured over the crystals, viz., 1 oz. of formalin to ½ oz. of permanganate is sufficient for 5 cu. ft. internal measurement. Temperature of machine kept at 103 degrees or not less than 70 degrees for about 30 to 60 minutes. After fumigation, open machine to air before putting in the eggs. Fumigation is safe and effective—make it a routine practice.

Advantage should be taken of the last rains of the season during this and next month for making final preparations in regard to green food supplies. Green feed is an important item in the diet of poultry, and no efforts should be spared to provide a continuous adequate supply throughout the year. Apart from its value in maintaining the health of the birds, an adequate supply assists in improving the yolk colour, and adds variety to the diet.

Lucerne is, of course, the most satisfactory crop, not only from the point of view of food value, but also to maintain a permanent supply. A few beds of lucerne grown in drills and watered, with reasonable attention, lasts four or five years, if not longer. This crop should therefore be given priority, and the best months for sowing are March and April, after preparing the beds thoroughly, but as lucerne does not grow profusely in the winter months, it is advisable to grow other crops to keep up the supply during the winter; for example, lettuce, barley, oats, wheat and rape. These crops would give an invaluable supply during the winter months.

Suitable substitute green foods are lucerne leaf meal and dried sunflower leaves, which could be pulverised for use in the mash or soaked in water before feeding. A departmental pamphlet on the Sunflower as a food for poultry is available on application.

APRIL.

GENERAL CROPS.

Do not forget witchweed cultivation. If sufficiently mature, begin cutting and stooking early maize over a small acreage, and plough up the ground whilst still damp between the rows of stooks. Early stooks must be small. Ride your manure and compost to the lands for spreading and ploughing under. If ripe, reap and husk early planted maize, and keep in a separate dump. Continue to make field selections of the best maize plants, and mark those required for seed with strips of coloured cloth. Lift any ground nuts and potatoes showing signs of making second growth. Make silage; cut maize for this when ears are in the dough stage. Feed sweet potato vines to stock, reserving any new growth of vines for grazing in May. Plough in green manure crops. Plough fallowed land. Keep potatoes reserved for seed on racks in a

cool but well ventilated place protected from frost, and green them in indirect light. Pick over your potatoes that may be lifted, and remove the bad or diseased ones. Winter cereal crops for grain can be sown towards the end of the month. Remember that good and deep ploughing to a depth of 7 to 8 inches is essential and the basis of successful arable farming. If the lands are not already ploughed so deep, increase the depth of ploughing an inch a year until this depth, or even more, is reached. On lands which have been ploughed for a number of years at the same depth, use a grubber or subsoiler to stir up the sub-soil without lifting it to the surface. Too much attention cannot be paid to good tillage. It is usually good practice to follow the plough *immediately* with the harrow or other suitable implement, to break down the clods before they bake hard; but do not make the tilth too fine as this encourages soil erosion. Continue breaking up new lands, as the earlier this is done the more complete is the decomposiion of the raw organic matter in the soil. When making hay of coarse legumes such as Velvet, Dolichos beans and cow peas, be sure that the vines are dry before stacking. Handle the hay as little as possible to avoid loss of leaf. Bundle and stook sunn hemp for hay, to avoid loss of leaf and protect it from rain. Lay in supplies of thatching grass for thatching and repairing roofs. The veld may be beginning to dry off. Consideration may be given to mowing or otherwise preparing fire guards, as a preventative against veld fires. Mow grass for kraal compost.

TOBACCO.

The grading of the brighter grades should be proceeded with as soon as convenient. All leaf which has cured green should be bulked separately and be regularly examined to avoid serious damage through over heating. Tobacco seed heads, when mature, should be removed from the plants and stored out of reach of rats and mice. Care should be taken to store these seed heads with the pods uppermost, as otherwise much seed may be lost. Clear and plough the land soon after the crop has been harvested. Burn old stalks as a control measure against a possible carry over of disease. For Turkish type, harvesting should be proceeded with as fast as the crop ripens.

FORESTRY.

Cultivate the soil in the young plantations either by hand labour or by machine. The cultivation will conserve moisture. Hoed-out weed growth should be applied as a mulch round the base of each young tree. Be careful not to pile earth round the stems of young trees. Covering the stems with earth even for an inch or two interferes with sap circulation and invites attack by termites. Prune the young trees to single stems. Any exceptionally strong undesirable branch growth may be checked by cutting off the leading shoot, but ordinary branch growth should not be touched.

If not already done, steps should be taken to prepare seedbeds for the slower growing species—pines, cypress and callitris—and seed of these species may be sown from now until the end of

June for planting during the coming rainy season. The soil should not be too rich and should not be over-watered.

CITRUS FRUITS.

During the first half of this month autumn budding can still be performed if the sap is still up and the bark of the stocks slips freely. Unprofitable and off-type trees that have been headed back for top working and which have been carefully thinned out may have the shoots on which February-March buds have failed re-budded to profitable varieties. If the March rains have been sufficient and ploughing and cultivation have been completed, continue cultivation to retain soil moisture and destroy winter weeds. If a dry March has been experienced and cultivation has been badly performed, irrigation should be commenced or continued to keep the trees and fruit in good order. If not already applied to the unthrifty trees which are late with their autumn flush, soluble fertilisers containing nitrogen and phosphoric oxide can be applied with advantage to these trees. The fertiliser should be worked into the soil with a cultivator and followed up with an irrigation. Exporters should have everything in readiness for packing the early fruit, which should be fit to market about the end of the month. Scale infested fruit will be unfit for export unless treated at once. See entomological notes for treatment.

DECIDUOUS FRUITS.

If not already done, orchards should be ploughed, harrowed and well cultivated to retain the soil moisture for spring blossoming and growth. Cut out all old fruiting wood of youngberries.

Order all trees for winter planting during June-July. August planting is unsafe for many early growing varieties of fruits.

All late apples should be harvested and stored or marketed.

VEGETABLE GARDEN.

Sow at once all that is required to fill up the vegetable garden before the soil has parted with all moisture. Seeds sown now will germinate freely, and plants will establish themselves more quickly than during the colder weather, which can soon be expected. A start should now be made at cleaning asparagus beds. This is a most popular vegetable and yet one rarely sees it cultivated in the ordinary Rhodesian garden. It is supposed to be difficult to grow, but this supposition is not borne out as, once established, a bed of asparagus is one of the most easily managed vegetables in the whole garden. Plant out from seed-beds cabbage and onion plants into their permanent quarters. Sow a full crop of peas, broad beans, turnips, onions, lettuce and radish, carrots and beet.

FLOWER GARDEN.

The garden can generally be depended upon to make a good show in the autumn and early winter, provided that the plants have been previously kept in a healthy condition by watering, mulching and feeding. Snapdragons and other seedlings, also cuttings, may

now be planted out into their permanent positions. Sowing may be made of hardy annuals, such as hollyhocks, larkspur, clarkia, pansy, petunia, sweet peas, gaillardia, godetia, lupin and candytuft. Bulbs of spring flowering plants may be taken up, divided and replanted. Put in cuttings of geraniums.

INSECT PESTS.

Maize. Although certain pests such as earworm and stalk borer may be in evidence, there are practically no operations against insect pests of maize that can be carried out economically in April except the destruction, where possible, of second generation borers by making ensilage (see March). General agricultural hygiene, of course, should not be neglected at any time of the year.

Tobacco. At this time of the year the adult beetles of the lesser tobacco wireworms (*Trachynotus*) appear, and begin to lay their eggs almost at once. The resulting elongated grubs damage the underground portion of tobacco stems during the early part of the following rainy season, damaged plants often becoming a total loss. The germinating seed of maize may also be attacked (see maize seed dressing, October). No economical methods of protecting young tobacco directly from attack by the wireworms has been found, but the adults can be baited now instead, and the number of the wireworms present in the wet season can be thus greatly reduced. Lands which are to grow tobacco next season, even new lands, should be watched carefully for the adult beetle, and baited if necessary. The bait is made up by dissolving 1 lb. sodium arsenite (locust poison powder) in 10 to 20 gallons of water and using this poison solution to moisten maize bran or meal to the consistency of a stiff dough. Paris green may be used instead of sodium arsenite, but the dry poison should be thoroughly mixed with the dry meal before the water is added. Some farmers report success with as much as 180 lbs. meal to 1 lb. Paris green. Either mixture should be made into pellets or balls, the size of a golf ball or less, which should be placed in the infested patches in the shelter of clods of earth if present, or in other sheltered places in which the adult beetles are prone to congregate during the day. When necessary, such shelters can be made by distributing small heaps of grass or bushes. The balls should be placed out in the late afternoon so that they may retain their moisture in the evening. Baits can be re-moistened by sprinkling water on them.

A beginning should be made early in uprooting tobacco plants in harvested lands, and if these lands are ploughed now, so much the better. If, shamefully, seed-beds have been neglected, all tobacco and allied plants growing in them should be destroyed at once.

Cotton. Damage to bolls from bollworms may be noticed by the flaring of the bracts and the dropping of the bolls. All dropped bolls should be collected and destroyed. Guinea fowl, turkeys, etc., can be encouraged to destroy stainers. Stainers may be attracted by traps of cotton seed or trash and destroyed.

Potatoes. Most of the potato crop goes into storage at this time of the year—either by being left in the soil or by being lifted and stored elsewhere. Tuber moth should be denied access to the

tubers in either case. Potatoes left in the soil for storage should continue to receive the protection recommended throughout the growth of the crop (see last month). When being lifted, tubers, if left out overnight, should be well covered early in the evening with a bucksail or double layer of over-lapping bags, otherwise they offer a tempting opportunity for egg-laying by field-bred tuber moths. Where suitable field precautions have been taken, there should be no serious storage problem during the winter months as far as insect pests are concerned. Infested tubers should be culled for immediate use or disposal during lifting operations, and not stored with clean tubers. Storage accommodation should be clean and moth-proof. Walls and ceilings of store rooms can be given a heavy coating of D.D.T. before the tubers are stored, and also any equipment, such as frames, which does not come into contact with the tubers. Seed tubers can be dusted lightly with D.D.T. powder.

Orchard. Collect and destroy infested citrus fruit to keep down false codling moth and fruit fly. Bait for the latter, if necessary (see March). Fumigate or apply oil sprays against scale insects such as red scale. Soft scale may be killed by oil sprays or resin wash. Aphis is easily controlled by any of these, or by tobacco extract or home-made tobacco wash.

Gardens. See extensive notes in "Insect Pests" for March.

In most agricultural pursuits, remember:—

"Cleanliness Aids Insect Control"

PLANT PATHOLOGY.

Spray irrigated potatoes against blight.

Control measures against fungus and bacterial diseases not usually required in April.

Repeat recommendations for March treatment of vegetables.

BOTANY.

Many grasses and plants, such as weeds or plants about which the farmer requires information, will be flowering. If an idea of their value is desired, it is first necessary to find out their botanical name. This can be done by sending specimens to the Government Botanist, P.O. Box 387, Salisbury. If parcels are marked "O.H.M.S., Plant Specimens," they may be sent post free.

Flowering and/or fruiting material is required, and it is best to send two or three specimens of each.

In the case of grasses it is usually essential to have the base of the plant cut at ground level or just below, for accurate determination. If the specimens are pressed between half sheets of newspaper and then rolled into a cylindrical parcel they will reach the department in suitable condition. Loose specimens in a box or other container are often unrecognisable on arrival.

PASTURES.

Hay-making should be completed this month if possible, as the protein content and nutrient value of grass decreases rapidly with the onset of the dry season. Veld hay should be raked up into

windrows immediately after cutting (where power mowers are used, the hay rake can preferably be attached to the mower), as exposure to the sun reduces the palatability and quality of the hay.

The feeding value of veld grazing drops rapidly in this month and high-producing animals are best grazed on planted pastures, where these are available, or on after-math pasturage from fields mown early for hay or silage. Failing this, pastures grazed down well early in the season will afford the best grazing and can be used towards the end of the month.

CONSERVATION.

1. Construct new contours in green crops (as these crops have to be ploughed in anyway) while labour is available, oxen in good condition, and the ground soft.

2. Rebuild old contours in green crops.

3. Maintain and clean out irrigation furrows, in preparation for winter crops.

LIVESTOCK.

Beef Cattle. All cattle should, of course, be looking very well at this time of the year, and in most herds the bulls will be running with the cows. The question of keeping them in good condition should be emphasised and, if necessary, they should receive some supplementary concentrates. Under intensive or semi-intensive conditions such as practised in the higher rainfall parts of the Colony, bulls should be taken from the herds towards the end of the month. On many farms and ranches the steers and culled animals will now be in their best slaughter condition, and arrangements should be made for their disposal before they lose condition. In certain parts where either particularly good grazing or feed such as mealie stalks is available, it may be possible to not only hold the condition of animals but also fatten them a little more. Whenever this can be done it will enable the producer to market his stock a few months later when prices are better. Don't forget to check through all calves and see that none require de-horning or castration. If not yet done, they should also be inoculated for quarter evil.

Dairy Cattle. For the production of milk the grazing will not be of much value, and the cows should be so fed that their production will be maintained and not allowed to go down. At this time of the year quite a lot can still be done to stretch the summer by means of feeding greens or grazing the cows on greens as was suggested for March. Young stock should be carefully watched and also given a little supplementary feed if they require it. A concentrated ration for dairy cows should contain not less than about 17 per cent. of protein. The dairy rancher should now watch his cattle very carefully, and unless he has ample feed available it will probably pay him to discontinue milking the majority of the cows so that the calves will do well.

Sheep. The sheep should still be looking very well and lambing should be in full swing in all parts of the Colony. Ewes with lambs should be given particularly good conditions so that they

will have ample milk for the youngsters. Grazing on legume stubble or hay aftermath will be of great assistance. Do not forget to continue dosing and to keep the sheep away from vleis and other wet places.

Pigs. If sufficient separated milk is not available so that the pigs will get not less than one gallon each per day some carcase meal should be included in the ration. The young pigs must do well and be pushed hard, otherwise they will not turn out good and economical porkers or baconers. The pens should also be well bedded.

DAIRYING.

These are usually the most favourable months for dairy operations. Cooler nights are now in evidence, and there is usually little difficulty in maintaining low temperatures in the dairy. If elementary precautions are taken, all cream delivered to the creamery should be first grade.

The need for high-testing cream is not so important as during the summer months. Provided the cream is despatched to the creamery three times a week, the test may be dropped to 40%.

The need for cleanliness in all dairy operations is equally important during the cooler months as during the hot period. Regular sterilisation of all dairy equipment after use should be a regular daily routine.

Immediate cooling after separation should be aimed at during all seasons of the year. Organisms, those both harmful and beneficial to cream production and ripening require warmth for growth and reproduction. Deprived of this, they are unable to produce undesirable fermentations and the ripening process is left in the hands of the creamery operator where it belongs.

VETERINARY.

Horsesickness and Bluetongue may increase. If dipping of cattle has been systematically carried out, tick-borne diseases should be decreasing, but if dipping has been neglected they will continue and even increase.

POULTRY.

The popular conception that the farming fraternity is hidebound with by-gone traditions is rapidly fading. The field of poultry farming as it presents itself to-day represents almost a complete change of front, the result of breadth of vision enabling the expansion of successful branches and the scrapping of unproductive lines and methods. Much of the smugness has vanished and we have become more unbiased both in practice and outlook.

Could one have visualised some years ago mammoth electric incubators and the present day demand for day-old chicks? The incubation season is now with us. It is the climax of much field work done in the selection of breeders, and it entails all the intricate business of mating, pedigreeing, and preliminary testing of birds for production and liveability. Great changes have taken

place since we climbed from the bottom rung of the ladder. We have found that recording and pedigree breeding is really the foundation of the industry.

Selected females of not less than 200 eggers should be placed in the flock breeding pens. Males for these should be the descendants of dams with records ranging from 220 to 240 eggs per annum, preferably of the same family or ancestry, and not closely related to the females.

For maintaining the pedigree lines it is necessary to make some arrangement for keeping the stud stock separate from the rest of the flock, for which purpose smaller breeding units are recommended. The breed influences to some extent the size of the breeding units, and with this also the vigour of the male birds. Breeding pens of eight to ten females in the Heavy Breeds, for example, the Australorp and Rhode Island Red, and ten to twelve females of the Light Breeds, for example, the Leghorn, to one male should prove satisfactory for small breeding pens.

The selection of the breeding stock should be made at least ten days before collecting the eggs for incubation. If less time is allowed, the maximum fertility may not be obtained at once. Either pullets or hens and either cockerels or cocks can be used in the breeding flock. If cockerels and pullets are used, they must be well matured, and not less than nine months of age. Hens are better than pullets, mainly because it is desirable to record them the first year as pullets; they are otherwise an unknown quantity in regard to production and liveability. Yearling and two-year hens are better than older hens, but normally good pedigreed stock may be used for several years, as long as they are useful as breeders.

When pullets are used as breeders they should be mated with cocks rather than cockerels. Where cockerels are used they should be mated with hens rather than pullets. The general use of pullets for breeding is not a good practice.

The breeding stock must be provided with comfortable quarters—well ventilated without draughts, and not overcrowded, four square feet of floor space per bird should be allowed. The birds should be well fed to keep them in good condition. The grain feed should be fed in litter to induce exercise and the mash given ad lib in hoppers. A supply of green food daily is important. Provide suitable conditions for dust bathing.

There is the question of the selection of eggs to be incubated, and their storage. Eggs for incubation must be not less than 2 ozs. in weight, and not to exceed $2\frac{1}{4}$ to $2\frac{1}{2}$ ozs. The hatchability of large eggs is not always satisfactory. Uniformity in size, shape and colour, with close shell texture, are the chief points for which to aim. The storage of eggs under suitable conditions is important; suitable egg racks are easily constructed, and it is preferable to provide some covering. A cool room, free from draughts, should be the aim. A room temperature not exceeding 65 degrees meets the conditions best. Store with small end down, and it is preferable to tilt or turn the eggs daily during the storage period. Eggs should be placed in the incubators in a fresh condition, weekly if possible; stale eggs result in poor hatchability and dead in shell.

MAY.

GENERAL CROPS.

Witchweed will still require attention in the stooked lands as well as in the standing maize until the first good frost kills it. Continue to cut and stook maize as it matures; make the stooks small to assist drying, and to prevent increase of diplodia. See that the stooks are secure, and pick up plants lying on the ground. Continue ploughing between stooks of maize. Give all maize husked, or in the husk, a chance to dry before riding to the dumps. Do not begin shelling if the ears are still damp. Do not use new bags for harvesting maize; use cane baskets to save bags. Make the dumps of unhusked ears as small as possible; the smaller the dump the quicker the grain will dry out. Grain on the cob dries extremely slowly, if at all, in dumps of large size. Do not mix unhusked ears from the stooks, with drier ears in a separate dump. from the standing crop. Keep the drier ears in a separate dump. Shell, bag, and stack such maize separately. When cutting maize for stooking, insist on the stalks being cut at ground level. The plough will not bury roots with stalks 8 to 12 inches high. A long stubble of stalks makes clearing of the ground for ploughing tedious and expensive. If not already harvested groundnuts should be lifted before the first frosts damage the hay. Sow most winter cereals on vleis or under irrigation, early this month. Feed your sweet potato vines to stock before they are killed by frost. Dig and feed tubers from end of month onwards. Towards ends of month harvest cattle pumpkins and melons, and handle carefully. Avoid bruising to prevent rotting. Place them in a dry situation in the open, and in a single layer. Supply plenty of roughage to cattle pens, kraals, and stables, to increase the compost supply. Cart ripe compost to lands for spreading. Do not attempt to plough in dry grass or quantities of maize refuse. The plough will not turn it under, and it will not rot before next planting season. Put such refuse in the compost kraals and make a good job of the ploughing. If the weather seems set fair commence brickmaking. A small kiln of bricks always on hand is useful. As labour permits, rethatch buildings in need of repair. Overhaul, grease and paint planters, drills and other implements not required until next season, and store away under cover. Place fertilizer orders for next season. The second ploughing of new land, (broken up earlier) should be pushed on with as opportunity occurs. Remember that cutting lucerne before it commences to flower weakens it. Give it a rest during the cold months, and cut oats instead. Keep on mowing grass for kraal compost.

TOBACCO.

Curing should be completed as early in the month as possible to prevent loss from frost. The bales of tobacco should be examined and turned weekly until they are despatched from the farm. All bulks must be inspected regularly and turned if necessary. Tobacco seed should be shelled as soon as the seed

pods are dry and the seed carefully labelled and stored in a dry place. The stumping, clearing and ploughing of new land, if operations have not already commenced, should be no longer delayed. Land which has just produced a crop should be ploughed and harrowed as soon after the harvest as possible.

Turkish Type. A careful watch should be kept over the tobacco in bales and these should be turned at weekly intervals.

FORESTRY.

Start pricking out coniferous seedlings into tins or beds when lateral roots have developed, and keep pricked out plants under partial shade for about ten days. Deciduous trees which are propagated by means of cuttings should be taken in hand. See that the fire lines are in order, and, in the case of woods which have formed canopy, remove inflammable material along the edges of plantations.

CITRUS FRUITS.

The harvesting of the early ripening fruit should be commenced about the first week in May. Exporters should cure their Washington Navels for a longer period than usual; this will enable them to detect the thick-skinned fruit easily. Where necessary, irrigation should be continued up to within ten days of harvesting. All ploughing and cultivation should be completed without delay.

DECIDUOUS FRUITS.

All holes should be completed and kept in readiness for June planting. Ploughing or digging and cultivation should be completed without delay. Overhaul the spraying machines.

VEGETABLE GARDEN.

It will be necessary during the early part of the month to clear off what remains of summer crops, such as haricot beans, peas, cucumbers, etc. Where winter deep rooting vegetables are to be grown, such as carrots, parsnips and beets, the soil and subsoil should be deeply worked, so as to allow a ready root run for these vegetables. A dressing of agricultural lime will be of great value in every section of the kitchen garden. At ½ lb. per square yard this will especially help to minimise future attacks of insects and fungus attacks. New asparagus beds may be made this month; old beds should be cut down, cleaned and kept in good order; also a light dressing of stable manure may be given to the beds. Planting may be made of all seedlings, such as cabbage, cauliflower, lettuce, onions, etc., and seeds of carrot, leek, lettuce, onions, peas, radish, turnip, parsnip, broad beans may be sown.

FLOWER GARDEN.

The month of May is a suitable one for the preparation of new flower beds. The ground should be well trenched, and if of poor quality, a light dressing of well rotted manure will be a distinct advantage. Too heavy dressing is not advised, as too rich a soil is likely to produce an abundance of foliage and very

few flowers. It is not too late to sow sweet pea seeds, but the best results come from early planting. By this time all bulbs for spring flowering will be planted. Delphiniums and other herbaceous perennials may now be cut down, and if necessary taken up, divided and replanted.

INSECT PESTS.

Maize. Clean up all sites and sheds which are to be used later for the temporary or permanent storage of grain, although you may have done so at the end of last season. Where practicable, new sites should be used. Examine about 100 of the ears having exposed tips which may be growing near old sites. If a fair percentage of these reveal the presence of weevil, the site is probably infested. If this is the only source of infestation, an examination a few hundred yards away should reveal a lower percentage of weevil, and a new site can be chosen. Prepare plenty of space on the chosen sites for pigeon-holing the stacks in order to dry the grain out thoroughly, especially if you intend to store it on the farm. If grain silos are empty, clean them out thoroughly and clean up the vicinity. Storage sheds and their vicinity should be kept clean as a regular routine. If empty, such sheds may be treated by spraying D.D.T. on the walls, rafters, equipment, etc., as described under "Insect Pests" in reference to tobacco sheds in September. Eliminate rats and seal up rat holes and crevices into which grain may have fallen or may fall.

Tobacco. Continue baiting for false wireworm if adults are still present (see these notes last month). Get tobacco lands cleared and ploughed where possible. After May, there will be only two months left in which to destroy all Virginia plants, including roots, to *prevent regrowth.* Start now. Plants will pull up more easily and the soil will take the plough to better advantage. Some of your troubles this year could probably have been avoided by an earlier start last year.

Cotton. Continue trapping and destroying stainers. All fallen bolls should be collected and destroyed.

Orchard. For citrus pests, see March and April "Insect Pests" notes. False codling moth and fruit fly may infest the fruit of guava during the autumn and winter. Collect and destroy fallen and stung fruit (prematurely ripened fruit is often found to be infested). Use the bait suggested for fruit fly on citrus in our March notes, or substitute a bait made by mixing 1½ oz. of lead arsenate powder to a smooth paste with a little water and incorporating this paste in a solution made by dissolving 2½ lbs. of white sugar in 4 gallons of water. This bait should be agitated frequently, whilst being applied, to keep the lead arsenate in suspension. It should be freshly made for each application. Apply as directed in March or October "Insect Pests."

Garden. See March notes, and be prepared to combat aphis and Bagrada bug on plants of the cabbage family.

In most agricultural pursuits, remember:—

"Cleanliness Aids Insect Control"

PLANT PATHOLOGY.

Spray irrigated potatoes against blight.

Control measures against fungus and bacterial diseases not usually required in May.

Repeat recommendations for March treatment of vegetables.

BOTANY.

Many grasses and plants, such as weeds or plants about which the farmer requires information, will be flowering. If an idea of their value is desired, it is first necessary to find out their botanical name. This can be done by sending specimens to the Government Botanist, P.O. Box 387, Salisbury. If parcels are marked "O.H.M.S., Plant Specimens," they may be sent post free.

Flowering and/or fruiting material is required, and it is best to send two or three specimens of each.

In the case of grasses it is usually essential to have the base of the plant cut at ground level or just below, for accurate determination. If the specimens are pressed between half sheets of newspaper and then rolled into a cylindrical parcel they will reach the department in suitable condition. Loose specimens in a box or other container are often unrecognisable on arrival.

PASTURES.

Improved vlei pastures will be particularly useful during this month in providing grazing for dairy stock. Care, however, should be taken to avoid too close use, as this will reduce their carrying capacity in the spring months.

Paddocks rested during February, March and April should be opened for autumn and winter grazing.

Mowing operations should be continued to provide material for compost making and as a cleaning-up operation.

CONSERVATION.

1. Construct new contours in green crops (as these crops have to be ploughed in anyway) while labour is available, oxen in good condition, and the ground soft.
2. Rebuild old contours in green crops.
3. Maintain and clean out irrigation furrows, in preparation for winter crops.

LIVESTOCK.

Beef Cattle. In most parts of the Colony cattle will now start going off in condition, and careful management should be practised with a view to maintaining their condition as long as possible. In the higher rainfall parts the bulls will now be out of the herds, but in the areas where they are still running with the cows, care should be taken that they do not get too thin and weak. The cows with calves should also be watched very carefully and given all the necessary additional attention which was recommended earlier in the year. Fat stock should also be sold where necessary. In parts where beef cattle are farmed intensively and where grazing is not too good, the young stock should be fed some supplements to keep

them going. Excellent supplements for this purpose are a daily ration of 1 lb. of cotton seed, or ½ lb. maize, plus ½ lb. monkey nut cake or 5 to 6 lbs. good legume hay. It is also now a good time to wean the early calves. They will, of course, definitely require a little supplementary feed to prevent them from going back. They should be kept in well bedded pens or in a good paddock in which they can graze and receive their feed. Bullocks which are intended for fattening in pens should either be put in before they start losing condition or run on the stalks for a month or two. This will keep them going very well and let them fill out still more.

It is now a good time to see to fire-guards, and these should be well and properly made, not only along the boundary fences but also across the farm so that it will be cut into a sufficient number of blocks to prevent large areas from being burnt out.

Dairy Cattle. For good dairy cattle the veld will now have very little food value and in many parts of the Colony it will be advisable to pen the cows and in the pens feed them on veld hay or maize stover as well as a good ration of legume hay and silage. This will be of considerable assistance in keeping up production. The young stock should also be watched and fed if necessary. Dairy ranchers should now definitely discontinue milking unless they have ample supplies of good quality roughage and some concentrates.

Sheep. Lambing will now be coming to an end and it will be advisable to keep the ewes and lambs on the best grazing. The herd boys should also be watched so that they do not herd the sheep too close together. Dosing should be continued, steps should also be taken to ensure that the ewes will get a little supplementary feed in the form of aftermath grazing or stubble or legume hay to ensure that they will have lots of milk for the lambs.

Pigs. On farms very little separated milk will be available, and it will be as well to see that sufficient carcase meal and bone meal are included in the rations. All pens should also be well bedded and some green feed fed to the pigs.

DAIRYING.

At this time of the year little difficulty should be experienced in producing cream of first grade quality.

Care should be exercised during the winter months to ensure that the milk is not allowed to become too cold before separation.

For efficient skimming, milk should be separated immediately after milking at a temperature of not lower than 90° F.

This should be a good period in which to overhaul dairy equipment.

The separator should be examined for any signs of wear and worn parts replaced. True up the separator so that it is standing level on a firm base.

Examine cans, buckets, strainers, etc., for signs of wear and arrange for rusty utensils to be retinned and unserviceable ones to be replaced.

VETERINARY.

Horsesickness and Bluetongue may still be in evidence, also Lumpy Skin Disease, especially if there are no early frosts. On well dipped farms deaths from tick-borne diseases should have finished. Quarter Evil often appears during this month.

POULTRY.

The successful rearing of chicks is actually the pivot point upon which the success of the poultryman turns. The aim should be, if possible, to raise stock in growth and substance equal to, if not better than, the parents. Any deterioration in this respect, especially with successive generations, is likely to court failure. The first essential for the successful brooding and rearing of chicks is to provide them with healthy conditions for adequate growth and development with the minimum mortality. In order to attain the required comfort of the chicks, which does not mean coddling them, it is necessary to provide suitable brooders. The requirements are:—

1. A Hover for the protection of the chicks, mainly for warmth and seclusion when they need it, either in the fireless or heated types of houses. The chicks need a continual supply of fresh air, or ventilation without draughts, which means a reasonably free circulation of air, with hygienic conditions.
2. The brooder must be large enough to accommodate the number of chicks without overcrowding.
3. Sunlight in the brooder for warmth and comfort, which also is nature's most effective germ destroyer.
4. Safety from fire should not be overlooked in installing heated brooder devices, and in the case of fireless brooders protection from veld vermin. Temperatures must be adequate and capable of easy adjustment and the chicks allowed to choose for themselves their own requirements in regard to warmth.
5. Convenience of operation—brooders which can be easily cleaned, and convenient for feeding and watering.

Exercise and fresh air are indispensable to sturdy growth. At the same time, they must be provided with some form of protection or warmth in which to go when they begin to feel cold. They must also have elbow room for exercising away from the hovers where the chicks can run about, scratching in litter and feeding.

Cannibalism is a pernicious habit undoubtedly induced at first by curiosity, the result under intensive conditions of the moving feet of other chicks, and as they have a natural taste for animal products, when blood is exposed, they seem to persist to the extent that the vice is transmitted to others. Cannibalism is fostered—(1) by overcrowding the chicks instead of giving them roomy quarters, and (2) by monotony through a lack of exercise and possibly a deficiency in the rations.

Keeping the chicks busy, by regularity in feeding—the grain given at frequent intervals, a little at a time, and supplying freshly cut green food, and keeping them interested, goes a long way in

preventing vices. Hen-reared chicks are not crowded in large numbers into small pens. Do they develop vices such as cannibalism?

The floor area of the brooding accommodation, including the hover, should be about ½ sq. ft. per chick less than 4 weeks of age. The area should then be increased to allow for exercise and growth. Separating the sexes, especially of large hatches which usually contain 50% pullets and 50% cockerels, is a satisfactory method of providing more room, otherwise larger accommodation must be provided for each sex housed separately.

Now let us consider the question of chills to which brooder chicks are so often susceptible. First, there are the travelled chicks which arrive at their destination apparently very healthy and full of bloom; there are also the local hatches which take place in dull cold weather; are placed in their brooders, and in a few days they begin to droop and die off. The mortality increases daily, perhaps for ten days, then stops. Post-mortem shows a chill on the bowels, or perhaps inflammation of the lungs, and obviously the chicks have been chilled from the time they were placed in the brooders. Not all of them would be chilled, hence some of them are not affected, but there are others which survive, puny, weakly chicks. We may find some of them die even at three or four months old, and generally the kidneys and digestive organs are affected.

Then there is another kind of chill which is common in heated brooders. Chicks begin to die, and continue to die; post-mortem reports show congestion of the lungs. Enquiry into the conditions shows the chicks have been over-heated. When let out in the morning they rush to the water vessels, and some often are found to be staggering, falling about and dying in a coma. In reality what is happening is a lack of ventilation under the hover, or, possibly, too many chicks for the size of the brooder. This causes the chicks to become moist and damp and gives the impression they are sweating. On being let out in cool air in the morning they are chilled. Some die and others survive, only to exist, and not to grow satisfactorily. The damage done is permanent.

It must be mentioned that too many people start poultry farming with too little knowledge; the result is they have to pay through losses sustained for the ultimate experience gained. A study of the requirements for successful brooding is important.

JUNE.

GENERAL CROPS.

Select seed from the very best of your own crops. You should always keep more seed than you need for planting. Do not shell and ride your maize to the railway unless it is fit for export or market. Provide ample dunnage for your maize stacked at the railway, or on the farm; maize cores are best. Select pumpkin and melon seed from the best specimens. Support your agricultural show, and make it a success by preparing and entering as many exhibits as you can. No one is more to blame for a poor

Show than the farmers themselves. Make a list of the seed requirements for next season; where purchases must be made place the orders early.

Veld fires must be anticipated and, if not already attended to, the mowing or burning of fire guards, both boundary and internal, should be proceeded with. Carry on with mowing grass for compost as long as there is any worth cutting.

TOBACCO.

The grading of tobacco should be proceeded with. Any bales stored on the farm should be turned occasionally, especially where one bale is placed on top of another. Arrangements for the grading of tobacco seed should be made for the coming season. Growers purchasing tobacco seed should place orders early with reliable distributors.

Turkish Type. All remaining leaves on the plants should be harvested as rapidly as possible to escape damage by frost. Leaf which will not colour readily should be wilted before exposure on airing racks.

FORESTRY.

Care should be taken by further ploughing of land or burning of grass that all fireguards round plantations are in good order and effective. Thinnings, where necessary, may be continued and fellings which are to be made should be carried out. Cuttings of deciduous trees may be taken and struck now. The pricking out of conifer seedlings into tins should be continued, and sowing of such seed for the coming planting season may be completed. A commencement may be made on preparation of land to be planted during the ensuing season, e.g., by stumping if necessary and ploughing where practicable.

CITRUS FRUITS.

Early ripening fruit must be harvested and marketed without delay. Mid-season varieties will be fit for packing early in the month. These should be shipped as early as possible, so as to extend the late variety export season as much as possible. Most late ripening varieties will require irrigating during the month.

A small amount of pruning should be done to keep balanced growth of trees. If fumigation is to take place, remove the small branches that touch the ground; cut out all dead wood and water shoots.

DECIDUOUS FRUITS.

General pruning may be done this month if the leaves have fallen. This should be confined, as far as possible, to the thinning out of diseased, weak, broken and dead shoots. Shorten back half-way long fruiting wood.

Tall trees may be reduced in height, and old and unprofitable trees headed back to induce the growth of new fruiting wood.

Trees that shed their leaves late may be pruned in July. Give a dormant spraying of lime sulphur 1 in 15 after pruning. The necessary preparations for planting trees should be completed during the month and planting commenced towards the end of the month.

Cultivation should be continued. Remove all precocious peaches when pruning. For moss (lichen) on trees, whitewash or spray with 1 lb. Copper Sulphate to 25 gallons of water.

VEGETABLE GARDEN.

All available space in the garden should now be thoroughly trenched and manured, the soil being well worked and loosened. Vegetables planted out for winter crops should be well and continuously cultivated which will help to bring them along quicker and with less watering. Late-bearing tomatoes should be sheltered from the cold winds by a grass shield. Beet, radish, carrot, parsnip, turnip, onion, leek, mustard and cress and tomatoes may be planted. Lift main crop potatoes.

FLOWER GARDEN.

Annuals for early spring flowering should be sown, preferably in paraffin tins cut lengthwise, in a place sheltered from the wind. Perennials, shrubs and ornamental tree seeds may also be sown. Trees, shrubs and roses should be pruned and all dead wood removed. Sweet peas require constant attention. Put in hardwood cuttings of shrubs. Keep violets watered regularly and weekly applications of liquid manure.

INSECT PESTS.

Maize. Clean up and plough lands as soon after harvesting as can be done. This is less essential at this time for stalk borer control, but helps considerably against other major and minor maize pests. Vlei lands infested by black maize beetle should be ploughed now and, where practicable, turned over to pigs, which can root out many thousands of the grubs. Further and frequent cultivation in the hot dry season is very effective in lands infested with this pest, but will be less necessary where pigs have been used.

Tobacco. Tobacco whitefly, which transmits the virus of leaf curl disease, breeds slowly but surely through the winter and increases rapidly in the spring. Its commonest host plant even at these times is the tobacco plant. A beginning should be made not later than NOW to destroy all volunteer growth, regrowth, and old roots and stalks in order to prevent the winter propagation and spring increase of this pest. Living tobacco roots in the soil can throw up regrowth sooner or later, and the foliage is meat, drink, and housing accommodation to appreciate whiteflies. Contented whiteflies should have no place on your farm.

Orchard. For citrus and guava pests, consult the "Insect Pests" notes for the last three months. The winter crop of figs is liable to be infested by the grubs of the fig weevil. The in-

fested fruit should be collected and destroyed. If this has been done regularly throughout the neighbourhood for the first crop, the second crop is not likely to suffer much.

Garden. Onions suffer from thrips. Consult notes for control of thrips on citrus given in "Insect Pests" for September.

Lands in General. Early ploughing is in general the best from the point of view of insect control, as it helps to kill weeds on which many pests persist. Repeated and thorough ploughing of eelworm-infested soil in the dry season reduces infection.

In most agricultural pursuits, remember:—

"Cleanliness Aids Insect Control"

PLANT PATHOLOGY.

Spray irrigated potatoes against blight.

Control measures against fungus and bacterial diseases not usually required in June.

Repeat recommendations for March treatment of vegetables.

BOTANY.

Many grasses and plants, such as weeds or plants about which the farmer requires information, will be flowering. If an idea of their value is desired, it is first necessary to find out their botanical name. This can be done by sending specimens to the Government Botanist, P.O. Box 387, Salisbury. If parcels are marked "O.H.M.S., Plant Specimens," they may be sent post free.

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In the case of grasses it is usually essential to have the base of the plant cut at ground level or just below, for accurate determination. If the specimens are pressed between half sheets of newspaper and then rolled into a cylindrical parcel they will reach the department in suitable condition. Loose specimens in a box or other container are often unrecognisable on arrival.

PASTURES.

During June both veld and vlei land are in a dormant condition, so the farmer with dairy or high-class stock should rely chiefly on feed (legume hay, silage, veld and planted pasture hay, etc.).

Mowing operations should continue to check scrub and weed growth, to clean up pastures and to provide material for compost making. Remember that mown pastures need never be burned and that mowing is one of the best means of improving the veld.

CONSERVATION.

1. Construct new contour ridges.

2. Rebuild old contour ridges.

3. Road repair work, paying special attention to disposal of water from road drains.

4. Maintenance work on storm drains.

5. Primary gully control work should include fencing of gullies and badly eroded areas.

6. Construct pasture furrows and vlei contours.

7. Carry out veld fire protection measures, with particular regard to gullies. Prepare holes for planting Kudzu.

LIVESTOCK.

Beef Cattle. In most parts of the Colony cattle will now be losing condition, and every effort should be made with careful management to arrange matters so that they do not go back unnecessarily through bad handling or neglect. The service season will also be just about over in the drier parts of the Colony, but it will be important to see that the bulls are kept in reasonably good and strong condition. The calves should, of course, be looking very well. If not, there should be a definite reason, and this should be found and remedied. In the intensive or semi-intensive beef herds all the calves should be weaned by now and given some supplementary food to keep them going. They should be penned and either fed in the pens or in the paddock where they graze.

Where stock are in saleable condition they should be disposed of unless their condition may improve for later sale. It is also a good time to pen steers intended for fattening. During the first month of fattening they usually do very well on a ration of good quality roughage such as legume hay, veld hay and silage. It seldom pays to feed steers on concentrates in the first month after penning. The veld cattle should be watched very carefully and not disturbed unnecessarily. The herd boys should also be prevented from herding the cattle too close together. From now on the "eye of the master" is going to be an extremely important factor for the successful running of any herd of cattle.

Dairy Cattle. In all parts of the Colony milking cows should, of course, be in pens and given all the good quality roughage they will consume. Young stock should also be assisted, and if this is not possible in the veld they should be penned like the cows and kept going during the dry months. All cows should now be receiving a ration of good concentrates according to their production. No dairy rancher should be milking any cattle at this time of the year, unless, of course, they have cows which calved very late in the season, and they have ample feed available for them. The calves and young stock should also be watched very carefully and given any help they may require.

Sheep. The ewes and lambs, as well as the other sheep, should still be looking very well. The ewes with lambs should definitely receive assistance, and this can best be given by allowing them to graze for an hour or two each day round a stack of legume hay.

Herd boys should be watched so that the sheep are not bunched too close together.

Pigs. With the cold weather approaching, it is important that the pigs should have lots of bedding in their pens and that they receive rations with sufficient protein and minerals. As was pointed out during the previous months, they should be given carcase meal if sufficient separated milk is not available. They should never be without some green feed.

DAIRYING.

At this time of the year little difficulty should be experienced in producing cream of first grade quality.

Care should be exercised during the winter months to ensure that the milk is not allowed to become too cold before separation.

For efficient skimming, milk should be separated immediately after milking at a temperature of not lower than 90° F.

This should be a good period in which to overhaul dairy equipment.

The separator should be examined for any signs of wear and worn parts replaced. True up the separator so that it is standing level on a firm base.

Examine cans, buckets, strainers, etc., for signs of wear and arrange for rusty utensils to be retinned and unserviceable ones to be replaced.

VETERINARY.

Horsesickness and Bluetongue will now be practically over, and inoculations for both these diseases can be carried out during the next five months.

Stiff Sickness may make its appearance and continue during the months of June, July and August.

POULTRY.

During the next few months the poultryman's time will be fully occupied—it is the busiest period of the year. Cleanliness and systematic methods of management and attention to details pays well.

The correct management in rearing chickens is of equal importance to feeding. To secure the required number of pullets with stamina for replacement in the laying flock's houses we must give attention to management, which includes environment, cleanliness, freedom from insect vermin, strict personal attention and feeding. Chick rearing should not be regarded as being a mechanical job. It requires constant observation for changeable weather, the possibility of overcrowding—and remember chicks can be chilled in the runs as well as in the houses.

All undersized, weak, crippled and badly hatched chicks should be destroyed.

Before the chicks are placed in the brooders the floors should have a light dressing of clean river sand or soil to absorb the droppings and to give the chicks a good footing. A small amount of clean litter, straw or grass cut short, will provide exercise and tend to keep the chicks active and interested. In both heated and fireless brooders their liberty should be restricted when removed from the incubator, and a good precaution in the case of brooder houses is to erect a temporary wire netting barrier when necessary around the brooder stove. At the end of about a week they can be given the liberty of the brooder house and the outside runs. In fireless brooders the space usually provided is sufficient for that purpose.

When the chicks are four to six weeks old it is generally necessary to remove them from the brooders to make room for others. The chickens are trained in the early stages of brooding, and training is again necessary for two or three days after their removal to larger accommodation. It pays to give them extra attention in that respect.

In feeding, the first thing to realise is that the chicks require for good health and satisfactory growth suitably balanced rations and the food should not be stinted. They are ready for their first food 36 to 48 hours after hatching, and chicks make quick growth in the early part of their life, the most rapid during the first 6 to 8 weeks. The ration must have a relatively high protein content to give the best development, approximately 20% of protein, and after about 8 weeks reduced to 15%, until they reach laying maturity.

In regard to quantity of food, the safest method is to supply the mash ad lib. in suitable hoppers and the grain feed at regular and frequent intervals daily without waste. The variation in weight from week to week and the ever-increasing amount of food required, suggest the undesirability of stating the exact amount that should be supplied. A system of feeding where the growing birds have access to all they require is the most desirable one. An all-mash ration which includes the grain feed could be supplied ad lib. instead of feeding grain separately. The mash should be placed in shallow trays or hoppers about 1 to 1½ ins. in depth during the first few days; larger hoppers would be required as the chicks increase in size, about 8 ft. of feeding space should be provided per 100 chicks for the first few weeks and later increased to 10 or 12 ft., to avoid overcrowding and molesting one another. The hoppers should be replenished at least twice a day or more frequently if necessary.

Chickens are reared satisfactorily on the dry mash system or a combined system of dry and moist mashes. Moist mash could be fed from about two weeks of age. The moist mash system is advantageous when milk is fed, which could be used as a medium for moistening the mash where available. It is better to restrict the feeding of moist mash to once a day and the dry mash supplied ad lib.

Chickens of all ages must have access to shade, clean drinking water, and ample succulent green food.

JULY.

GENERAL CROPS.

Keep mowing grass for compost, if you have it to cut. Support Agricultural Shows and add to your list of exhibits. Advertise your goods through the Shows, interested people will see them. If you need to make purchases of seed for next season, judge by the exhibits on the Show what grower can best supply your needs, and place your orders accordingly. Attend the Shows and go

there to learn all you can about your business. Seed maize previously selected in the field should be butted and tipped, and hand shelled. Keep the butt and tip grain for planting by hand. Do not over-irrigate winter crops, and do not irrigate when the wind is from the south, as this often means frost at this time of the year. Troublesome weeds such as wild oats, darnel grass or drabok should be removed from cereal crops by hand. Ploughing should be pressed on with, and maize stalks and other trash should be collected and composted. A land littered with unrotted stalks and roots cannot be brought to a suitable condition for planting, and subsequent cultivation. Silage, sweet potatoes, and other succulent feeds, will have come into general use now, the potatoes being lifted from the land as required. The application of phosphate fertilisers to be ploughed or harrowed in, can be begun. Plough it under where possible. Take the opportunity during this, or the next month or two of inspecting all boundary and paddock fencing and gates, and effect repairs when required. Give a coat of paint to implements, wagons and carts. This protects the wood work from rotting, and the iron from rust. If not already marketed the main potato crop will be sold about now, before the warm weather causes sprouting.

TOBACCO.

No notes for this month.

FORESTRY.

Care should be taken to protect all plantations from fire by hoeing or ploughing belts round them and burning any grass likely to be dangerous. Cuttings of various deciduous trees, e.g., Carolina Poplar, may be taken and struck in nurseries. Continue pricking out conifers into tins and beds. If labour is available, preparation of land for planting to be taken in hand.

CITRUS FRUITS.

The harvesting of mid-season oranges should be completed early in the month; late varieties should be fit to export by the middle of the month. The dead wood should be cut out of all harvested trees; this will minimise mechanical injury occurring with next season's fruit. Trees that are to be fumigated should have the lower lateral branches that touch the soil removed. Trim the trees until all foliage is just clear of the ground. The irrigation of late varieties must be continued and the cultivators kept going. Mark all trees when in fruit if the quality is bad; these may be cut back in August for top working to a good quality fruit. The soil of the early and mid-season varieties may be allowed to become fairly dry, for irrigation of the harvested trees may start an out-of-season growth which will enable pests to flourish and increase for the main spring blossoming flush. Prune lemons if the outer branches are long and sprawley.

DECIDUOUS FRUITS.

Pruning must be continued, and, if possible, completed this month. Apple trees must not be allowed to produce fruit wood at the tip of branches: shorten back to force wood growth. Order

fruit packing material. The planting of all varieties is best if done now. Add a liberal amount of water at planting time, then cultivate the basins. Sufficient moisture will be thus retained to keep the newly-planted trees going until they start active growth. Repeat waterings when necessary. If trees arrive from the nurseryman in a dry and withered condition, immerse them in water for 12 or more hours until they regain turgidity; then plant. Running water is best. It will be advisable to irrigate all trees towards the end of the month.

VEGETABLE GARDEN.

Sow turnips, beans, peas, onions, cabbage, parsnips, radishes, lettuce and spinach. Plant out onions and cabbage when large enough. This is a good month to divide rhubarb crowns and replant in deeply worked and well manured soil.

FLOWER GARDEN.

Seeds of most annuals, perennials, shrubs and ornamental trees may be sown. The pruning of roses should be attended to early. Dahlias and other summer-flowering bulbs should be taken up, divided and replanted. Sweet peas require attention and staking. Cuttings of bougainvilleas may now be put in. Divide and replant overgrown barberton daisies.

INSECT PESTS.

Tobacco. Cleaning operations on tobacco lands should be completed as early as possible, the latest time allowed by law being 1st August for Virginia type tobacco and 1st September for Turkish type tobacco. No tobacco plants or roots should remain undestroyed after these fixed dates (see notes on tobacco whitefly, June).

Have you chosen your seed-bed site ? Choose a site now, a new one if possible, and, whether it is new or old, remove all plants growing on it as a measure against pests which may attack the young seedlings later; include a strip of say 30 yards all round it. Perfectly clean cultivation for at least six to seven weeks before the first seedlings show will give them a good start against cutworms and will help to avoid breeding up a heavy cutworm population which may later infest the lands.

Potato. The last of the crop will be lifted this month. See our April notes on lifting and storing.

Orchard. Continue to destroy figs infested with fig weevils.

Garden. See March notes on cabbage aphis and Bagrada Bug.

Insecticides and Spraying Equipment. Supplies of any insecticides which are to be used later in the season, such as Paris green or other arsenicals, tobacco extract, insecticidal oils, fumigants, or modern synthetic insecticides, should be laid in now. Spray equipment should be overhauled and any necessary parts or spares purchased. If new equipment is needed, get it now.

Insecticides notwithstanding, remember that in most agricultural pursuits:—

"Cleanliness Aids Insect Control"

PLANT PATHOLOGY.

Destroy all Virginia tobacco stalks. No growing plants must be left in the lands or compound after August 1st.

Prune fruit trees. Cut out dead wood well below discoloured portion and burn. Paint large wounds with carbolineum. Collect and burn old "mummied" fruit. Apply winter wash of lime-sulphur (1—15) to apples, pears and peaches. Prune vines and spray with lime-sulphur (1—8). Prune and spray roses with lime-sulphur (1—15). Select maize seed carefully only from cobs showing no discolouration of grain, to avoid Diplodia. Spray irrigated potatoes with copper fungicides.

BOTANY.

Many grasses and plants, such as weeds or plants about which the farmer requires information, will be flowering. If an idea of their value is desired, it is first necessary to find out their botanical name. This can be done by sending specimens to the Government Botanist, P.O. Box 387, Salisbury. If parcels are marked "O.H.M.S., Plant Specimens," they may be sent post free.

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PASTURES.

The notes supplied for the month of June apply equally to July.

CONSERVATION.

1. Construct new contour ridges.
2. Rebuild old contour ridges.
3. Road repair work, paying special attention to disposal of water from road drains.
4. Maintenance work on storm drains.
5. Primary gully control work should include fencing of gullies and badly eroded areas.
6. Construct pasture furrows and vlei contours.
7. Carry out veld fire protection measures, with particular regard to gullies. Prepare holes for planting Kudzu.

LIVESTOCK.

Beef Cattle. From now on beef cattle will require very careful watching and in particular should it be seen to that cows with calves are on the best grazing available. In the high rainfall areas where intensive production is practised all the calves should, of course, be weaned by now and be properly assisted with some supplementary feed so that they will continue to develop normally. It may also be necessary to assist any cows which were in poor

condition when weaned. On the ranches the calves will, of course, still be running with their dams, and the whole matter will be one of careful management.

In parts of the Colony and in certain areas cattle will now be at their best for slaughter, and every possible effort should be made to have them disposed of before they lose condition.

Where bullocks are being fattened in pens and where they were put in a month ago they should now be given a small allowance of concentrates. The not very experienced feeder will be wise to visit some experienced cattleman and see just how fattening is being carried out. Full information can also be obtained from the Department of Agriculture.

Dairy Cattle. Dairy cattle will be managed along much the same lines as were recommended for June. Cows in milk should all be in pens and fed all the good roughage they will require, plus a good allowance of concentrates according to their production. Care should also be taken that cows or heifers which are heavy in calf, and other young stock, are kept going.

Sheep. Ewes with lambs should receive assistance as was suggested for the previous month, otherwise they will not have sufficient milk to ensure normal growth in the lambs. Grazing for a few hours daily round a legume hay stack, plus 2 or 3 ozs. of maize each, will be all that is necessary. Dosing should still be continued and the lambs also dosed for tape worm.

Pigs. With very little separated milk available, a full allowance of carcase meal should be included in the ration. Full particulars of properly balanced rations for feeding to pigs during the winter months can be obtained from the Department of Agriculture. Every possible effort should also be made to ensure that all pigs get a small allowance of green feed daily. This will not only keep them healthy but also supply them with all the necessary vitamins which are lacking in the usual grain rations. With the cold weather the pens should also be very well bedded, otherwise rheumatism will soon be troublesome.

DAIRYING.

The weather during these months makes dairying comparatively easy. With due care and attention first grade returns should be received.

Cream testing in the vicinity of 40% may be separated and cream should be railed to the creamery three times a week.

Immediate cooling after separation is an essential routine for successful dairying.

Avoid milking in a dusty and manure laden kraal. The milking site should be cleaned daily, and the use of reims for tying the legs of cows at milking time should be abolished. Cow hobbles afford the best means of securing the legs of cows, moreover these hobbles can be washed, and sterilised with the usual dairy equipment.

VETERINARY.

Horsesickness and Bluetongue will now be practically over, and inoculations for both these diseases can be carried out during the next five months.

Stiff Sickness may make its appearance and continue during the months of July and August.

POULTRY.

During this month readers will be preparing for the transfer of the early-hatched chickens from the brooders to accommodation in large runs or range where they will be under good environmental conditions on fresh ground, and having more room they ought to continue to make satisfactory growth when properly fed. There will be others to follow in due course and the young stock should be hardened off during the final brooding stages before removing them to the range accommodation. They are removed from the brooders to this intermediate accommodation as soon as they are well feathered, preferably during spells of mild weather which occur during this period of the year. Their housing accommodation will now be larger and more open and it is advisable to provide them with overhead protection within their new quarters during the first few nights after being transferred. A wooden frame covered with a single piece of hessian (larger type of hover, approximately 2 feet x 6 feet), and placed along the back wall about 2 feet from the floor of the house would give them sufficient protection should they require it during the night. The corners at the back of the house should be rounded off to minimise the possibility of corner crowding—a simple device is to take ordinary smooth straight fencing wire, bent to form a triangle, the base of which could be 12 inches in length and the two sides about 18 inches high; fasten the ends securely, and cover with ½ inch mesh wire netting. This is placed across the corners of the house; the space between this and the corner can be filled with coarse grass of suitable length. The care of the chickens during the first few nights after transferring them is important—it is a critical period for the youngsters, especially in changeable weather, they are apt to be chilled if exposed to cold, without sufficient overhead protection during the day or at night.

On removing them from the brooders, separate the cockerels from the pullets and house them apart. Thrifty chickens which have received proper nourishment during the brooder stage should weigh from 1¼ to 1½ lbs. at eight weeks of age, depending on the breed. The development and weight of chicks depend on two main factors—suitable balanced rations, and the amount of food consumed each day. The food should not be stinted.

The cockerels which are not required as stud stock should be disposed of to the best advantage at six to eight weeks of age or as table birds when they are 2½ to 3 lbs. in weight from about twelve to fourteen weeks old. Cockerels for table purposes should not be kept longer than 18 weeks of age, except for special market requirements, as, for example, caponising.

The pullets should be well cared for, kept growing steadily, and free from insect vermin. Provide them with suitable conditions for dust bathing. Apart from supplying nourishing rations, their constitutional vigour must be kept at a high level. The aim should be to provide hygienic environment conditions as well as the proper foods, including plenty of green food.

A constant supply of water is essential. Keep the water vessels clean and sanitary and protected from the sun. The water vessels are often neglected, the interior becomes coated with algae, and sick birds are the result. Scrub the interior of the

water vessels regularly once a week in disinfectant. The growing stock must have access to clean pure water ad lib. In hot weather a single chick may visit the water vessels a dozen times an hour for a drink.

Ducks. The final selection of the breeding ducks should be made this month and penned off. The young ducks should be laying and older breeding ducks may be expected to commence laying and reach full production next month. Large vigorous breeding ducks with broad deep bodies and constitutional qualities give the best results for raising table birds. Active birds of good quality should be selected, avoid coarse ungainly birds.

Waterfowl when kept as part of the farm poultry should be confined by themselves, not mixed with other poultry. They should have houses, sheltered runs, and water facilities provided for their own use in all cases. The housing of ducks is quite a simple matter, and the general principles which apply to poultry apply also to ducks, open-fronted, preferably enclosed with wire netting and a door, and situated on well drained soil. Swimming water is not absolutely necessary for the breeding birds but it is beneficial to them. A small pond, say 6 ft. square and 12 inches deep with sloping sides would be sufficient for a flock-mated pen of fifteen birds. The fertility of duck eggs is generally more satisfactory when the breeding stock have access to water, but not necessarily deep water for swimming. Ducks lay their eggs in the early morning and are liable to deposit them at random and in water if not controlled. Ducklings reared for table should not have access to swimming water. Ducks appreciate grass nests, single-brick partitions on the floor of the house would suffice for these. Where swimming water is provided breeding ducks should be confined in the houses, supplying drinking water until 10 a.m. when they could be released, after having laid their eggs for the day.

Turkeys. Preparations should be made for the breeding season. Domestic turkeys still follow to a great extent the habits of their wild ancestors and they should as far as possible be given the opportunity to gratify their wild instincts, as, for example, ranging over wide areas in search of food but herded if necessary, and roosting in whatever sheltered trees or nook they may select, there should be a minimum mortality. Adult turkeys do not require much protection from the weather in Southern Rhodesia. Where it is found necessary to provide sleeping accommodation for them, a fairly well-ventilated shelter with a thatched roof and grass sides would be economical to keep off damp, and they like well-elevated perches. Cone-shaped grass-covered shelters with an opening on one side should be provided for nesting in; these should be located conveniently for the attendant in the vicinity of their range and during the early part of the day herded near that area before encouraging them to unlimited range where there might be difficulty in locating the nests they otherwise select themselves. They will soon be induced to frequent the nest provided for them when properly herded and in establishing a regular routine before they commence breeding. Food should be given near their roosting quarters to encourage them to return during the afternoon.

The poults are little more difficult to rear than chickens. What has been said with reference to the principles of feeding and rearing chicks applies also to turkeys and other poultry. The necessity for sanitation cannot be over-emphasised. Avoid contamination of the feed and water. Their food should be supplied in hoppers.

AUGUST.

GENERAL CROPS.

Prepare your compost heaps. Grade the potatoes properly according to size. The buyer wants potatoes—table or seed—of even size, and not large and small mixed. Select and clean farm-grown seeds, ready for next season's planting. Label the bags with name and weight of contents. Build a proper shed for greening your seed potatoes. Green oats or barley fodder on wet vleis, or under irrigation, will become ready for cutting. Press on with ploughing and cross-ploughing when necessary. Decide what crops are to be grown next season and, if you think fit, discuss the matter with officers of the Department of Agriculture. If you have not already purchased all your seed consider the matter and place your orders. If in doubt consult the Department. Potatoes can be planted under irrigation or on damp land. Cart and spread your compost and farmyard manure, and plough it under at once, to avoid loss of nitrogen. If you have any long stable manure apply it to your stickiest land, or to land intended for legumes. The application of fertilisers to land can continue. If you do not already have one, put up an implement shed, even if it be only poles and grass. Keep wagons and scotch carts under a similar shed, or in the shade of trees. Speed up the making and burning of bricks, if this work is still in progress. Open holes for hand planting maize, and make them at least 4 inches deep to allow for silting by early rains.

TOBACCO.

The seed-bed site should be cleared and well ploughed preparatory to burning and sowing. The usual date of sowing first seed-beds is 15th September. Bulletins covering every phase of tobacco culture can be had on application to the Chief Tobacco Officer, Department of Agriculture, Salisbury.

FORESTRY.

Cuttings of ornamental shrubs, roses, etc., struck in sand last month should be transplanted into good soil as soon as they show a healthy growth of leaves. A large percentage of cuttings will damp off if left in sand longer than 6 weeks. No manure should be added to the potting soil. Seed-beds should be prepared and gum seeds sown if required for planting early in the season. If the trees are to be grown in seed-beds only and not in tins, then gum seeds

should not be sown until October, or later, as they will get too large. Rooted Carolina Poplar cuttings should be planted out in prepared sites and given occasional heavy waterings until the rains commence. Make sure that all fireguards are in order.

CITRUS FRUITS.

The first or spring growth should commence about the middle of the month, and the trees should have a good soaking of water when the new growth commences. If Washington Navel oranges are to set their main crop, frequent irrigations must take place from the time of blossoming up to the rainy season. These irrigations create the necessary humid conditions which are so essential to secure a satisfactory setting of this orange. It is advisable to stimulate the growth of unthrifty trees with an application of one to one and a half pounds of nitrate of soda when the first irrigation is given, this application of fertiliser to be followed by good cultivation. The amount of fertiliser recommended is for mature trees. The packing of late varieties will continue throughout the month. No bearing trees should suffer for want of moisture. Irrigation should not take place immediately before the harvesting of export fruit—at least ten days should elapse between irrigation and the harvesting. This is the best month to cut down citrus trees for re-sorting to better varieties. Whitewash the trunks to prevent sun-scald. As the citrus fruits are harvested, all dead, diseased and broken branches and shoots should be carefully cut out before the trees come into new growth.

DECIDUOUS FRUITS.

All plantings of deciduous trees should be completed by now, as the late planting of these trees is generally unsatisfactory. Pruning may be continued up to the middle of the month. It is advisable to water or irrigate all deciduous trees before blossoming; if possible, a second irrigation should be given after the trees have set their fruit. Follow up the irrigation with good cultivation. Whitewash the trunks of fruit trees to prevent sun-scald.

VEGETABLE GARDEN.

Plant out asparagus, cabbage, cauliflowers, onions and early potatoes Sow seeds of tomato and other plants that are susceptible to frost in a sheltered position; also seeds of various vegetables and salads for summer use.

FLOWER GARDEN.

Complete digging or forking over the soil as early as possible. Divide and replant dahlias, delphiniums, Shasta daisies, etc. Plant bulbs—tuberoses, arum lilies and gladioli. Sow seeds of hardy annuals. Mulch newly-planted roses, shrubs, etc. Take chrysanthemum cuttings. Fern and other plants in tins or pots may be repotted or topdressed. Begonias and gloxinias may now be started into growth.

INSECT PESTS.

Maize. If you do not store maize, get the complete crop off the farm as early as you can. If you do store maize, store it under hygienic conditions—preferably in well constructed and well protected silos. Shelling dumps and sheds where grain has been stored should be cleared up and the refuse suitably disposed of according to its nature. Most if not all of the weevil infestation of maize in the field has come from these and similar sources from mid-summer onwards. Clearing up now prevents huge increases from occurring in stored maize from October onwards, and so reduces the potentialities of field infestation therefrom next season. There is an important cycle in which field and storage infestations are inter-related. Break this cycle. Do it thoroughly, and now. See the Rhodesia Agricultural Journal for September, 1940, or Bulletin 1161. If you store maize or other produce in stacks, lay in plenty of dunnage beforehand so that you can provide cat-space under the stacks. Cats catch rats.

To reduce storage losses from both mould and weevils, go to some trouble to dry out the grain before storing it. Do it properly once and you'll be a convert.

Tobacco. Be a little fussy about the cleanliness of tobacco lands (see previous months' notes). By law you should have no living Virginia plants or roots in the lands this month, and Turkish must be similarly taken care of by 1st September. Knowing this, can you look a policeman in the eye ?

Every effort should be made to dispose of the entire crop as soon as possible after curing. The retention of any tobacco at all for the following year's sale, although occasionally of a little financial advantage, is bad practice, and has sometimes resulted in the entire loss of the tobacco in addition to the enforced restricted sale of some of the *new crop at prices advantageous only to the buyer*. Similarly, it is inadvisable to keep stocks for native rations. Owners who cannot resist the temptation to keep tobacco for rations should keep it in a barn where it can be heated to over 125° F. for a day or two every month. Such heating will kill pests and not do much harm to the type of tobacco that is usually retained for rations. Grading sheds, barns, and other buildings where tobacco leaf has been handled or stored should be thoroughly cleaned and all tobacco waste and unwanted tobacco burned or composted at once. Attention should be given to cracks and crevices in the floors, walls, and equipment of premises to ensure that no scraps of leaf are lodged there. Rafters, tops of walls, and other places where dust collects should also be examined. Unless the cleaning up process is carefully performed, unnoticed pests of stored tobacco will not be eradicated and may infest the following year's crop with financially serious consequences to the owner. Cleaning up should be followed by lime-washing, as required by regulations.

Potato. The potato tuber moth begins to speed up its rate of increase towards the end of this month. If moths fly out when tubers are disturbed, or are noticed on ceiling, frames, etc., apply a coat of D.D.T. (see April) on the walls and other places where it will not come into direct contact with tubers for consumption.

If a summer-crop is to be grown, the site should not be near that of a winter crop.

Orchard. Any remnants of the late guava crop which may be present should be collected and destroyed to kill the caterpillars of the false codling moth, especially if the trees are near citrus orchards. Citrus trees may be sprayed or fumigated against scale insects unless the trees are in blossom. Infestations by aphis on the young shoots can be cleared up with tobacco extract sprays before the blossoms appear.

Garden. See July notes on cabbage aphis and Bagrada bug. In most agricultural pursuits, remember:—

"Cleanliness Aids Insect Control"

PLANT PATHOLOGY.

Remove all Turkish tobacco stalks and destroy before September 1st. There should be no growing tobacco of any kind on the farm during this month. Prepare tobacco seed-bed sites and burn. Burn a margin of veld round the sites to reduce insect carriers of virus diseases. Clean and treat tobacco seed. Disinfect or steam seed-bed cloth.

Overhaul spray pumps and order spray material.

Clean all maize lands, especially of diseased cobs, which should be burned. All stover should be composted. Continue seed selection. Make sure all cobs for Shows are disease-free.

Spray irrigated potatoes with copper fungicides. Continue control measures for vegetables. Cover the soil with a loose mulch to control blossom-end rot in tomatoes and head rot in lettuce.

Treat seed of summer ornamentals and vegetables before sowing and dust soil after sowing with Bordeaux powder to prevent damping-off.

Prepare orchard spray equipment ready for spring schedule. Apply green-tip spray and continue as required on apples. Spray peaches with lime-sulphur (1—120) to eradicate mildew. Dust vines and mangoes with sulphur before and after flowering. Dust strawberries with sulphur and nicotine against mildew and aphids which carry virus diseases.

BOTANY.

Many grasses and plants, such as weeds or plants about which the farmer requires information, will be flowering. If an idea of their value is desired, it is first necessary to find out their botanical name. This can be done by sending specimens to the Government Botanist, P.O. Box 387, Salisbury. If parcels are marked "O.H.M.S., Plant Specimens," they may be sent post free.

Flowering and/or fruiting material is required, and it is best to send two or three specimens of each.

In the case of grasses it is usually essential to have the base of the plant cut at ground level or just below, for accurate determination. If the specimens are pressed between half sheets of newspaper and then rolled into a cylindrical parcel they will reach the department in suitable condition. Loose specimens in a box or other container are often unrecognisable on arrival.

PASTURES.

Sand-veld vleis should be burned every second year in this month or early September, if they cannot be mown and the natural grass cover is coarse and unpalatable. It is important that the stock should be kept off the burns until fair growth has been made. Use of them should be made only sparingly at first to prevent the stock from scouring badly.

Dryland paddocks should be used to best advantage, as there is no response to resting at this time of the year.

CONSERVATION.

1. Construct new contour ridges.
2. Rebuild old contour ridges.
3. Road repair work, paying special attention to disposal of water from road drains.
4. Maintenance work on storm drains.
5. Primary gully control work should include fencing of gullies and badly eroded areas.
6. Construct pasture furrows and vlei contours.
7. Carry out veld fire protection measures, with particular regard to gullies. Prepare holes for planting Kudzu.

LIVESTOCK.

Beef Cattle. The position now remains very much the same as during July, except that conditions are probably slightly worse, and allowance in the feeding and management of the stock should be made for this. The main thing to do is to see that the animals do not lose condition unnecessarily at this time of the year, otherwise it becomes very difficult to pull them through towards the end of the dry season. Slaughter stock should also be sold wherever they are in their best condition, and where steers are being fattened in pens their grain allowance should be increased, depending on how they are thriving and what condition they are in. Here again do not hesitate to ask for sound advice.

Dairy Cattle. These will, of course, have to be kept in pens for quite a few months more in the drier parts of the Colony where early vlei grazing is not available. It is important that they should be well fed to maintain production. In parts where grazing is very poor, the dry cows and heifers should, of course, also be penned and helped.

Sheep. Much the same as during July, except that the assistance to the ewes with lambs should be increased. The lambs will be due for weaning during September, and in view of this every effort should be made to get them as well-grown and strong as possible at that time. Dosing should also be continued.

Pigs. With very little separated milk available, a full allowance of carcase meal should be included in the ration. Full particulars of properly balanced rations for feeding to pigs during the winter months can be obtained from the Department of Agriculture. Every possible effort should also be made to ensure that all pigs

get a small allowance of green feed daily. This will not only keep them healthy, but also supply them with all the necessary vitamins which are lacking in the usual grain rations. With the cold weather the pens should also be very well bedded.

DAIRYING.

The weather during these months makes dairying comparatively easy. With due care and attention first grade returns should be received.

Cream testing in the vicinity of 40% may be separated and cream should be railed to the creamery three times a week.

Immediate cooling after separation is an essential routine for successful dairying.

Avoid milking in a dusty and manure laden kraal. The milking site should be cleaned daily, and the use of reims for tying the legs of cows at milking time should be abolished. Cow hobbles afford the best means of securing the legs of cows, moreover these hobbles can be washed, and sterilised with the usual dairy equipment.

VETERINARY.

Horsesickness and Bluetongue will now be practically over, and inoculations for both these diseases can be carried out during the next five months.

Stiff Sickness may make its appearance and continue during this month.

Note. Quarter Evil, Anthrax, Scab in Sheep and Foot and Mouth Disease are non-seasonal, and should be watched for all the year round.

POULTRY.

The termination of the breeding season is approaching in regard to incubations for the replacement of commercial laying flocks. Incubation after the month of August is almost entirely restricted to waterfowl and turkeys.

In this Colony the two best months for incubation are July and August, with early hatching in June and late hatching to the middle of September. Earlier hatched chickens are often precocious, maturing prematurely followed by the production of undersized eggs. Late hatched chickens in large numbers after September are usually slow in growth, often unthrifty, and more susceptible to diseases and intestinal parasites, the result of the rearing area becoming fouled since its occupation during the sea-

son by the earlier hatched chicks. From every point late hatched chickens are uneconomical, mainly but not entirely due to the environmental and climatic conditions with which they have to contend. Late hatching is often continued with a view to replacement of losses that might have occurred early in the season, or, as often as not, a decision is made to bring off just one more batch for luck. But unfortunately late hatched stock can never replace the early losses. In any case, they are slow-maturing, and for this reason alone their revenue-earning capacity is considerably reduced.

As the warm weather approaches, the growing stock are more susceptible to attack by insect vermin, which are more troublesome during the hot months of the year. More will be said later about lice, mites, and cleanliness; in the meantime keep an eye open for insect vermin—this means more than just casual observation. Apart from the fowl tick and the flea, the most important external parasites to guard against are the red mite, scaly leg, and various body lice. Fortunately these do not thrive under hygienic conditions. Sanitation is of the greatest importance in minimising the presence of lice, fleas, and mites. There can be no excuse for the lack of cleanliness in the modern poultry yard. The poultry houses, roosts, dropping boards, brooders, nest boxes, drinking vessels, and floor litter should all be kept clean and sanitary.

Never fail to provide a suitable site for a good dust bath in which the adult fowls and chicks can dust themselves whenever they wish—it is natural for them, as in doing so they free themselves of body lice. Just loose, pulverised moist earth is refreshing to fowls, in a cool position, with partial shade.

Ailing birds are usually unprofitable and the first victims of these parasites, which makes it important to cull out the unthrifty birds, retaining only active healthy stock in the flock.

Most of us are familiar with individual birds that would pass any reasonable test for health and vitality but lack productive capacity. The word "cull" is used to denote the type of stock that will never make a good breeder, or if retained for commercial purposes will not survive its full period of usefulness profitably. Rather than retain such stock, which would thus reduce the profits, it would be preferable to adopt a "no waste" policy by timely culling instead of allowing mortality by natural causes. The term "culling" is usually applied to the removal of poor layers from the flock. In its broader sense it is applied to the sorting out of undesirable eggs for incubation, weakly chicks and pullets, cockerels, hens or cock birds from the more desirable birds.

The aim of the chick rearer should be to give the chickens a fair chance without any coddling. A common mistake in poultry rearing is to think that as soon as the chick is past the brooding period the young stock can be made to rough it without regard to housing and management. It is true the young stock require to be hardened off, but not in effect by nature's methods of the survival of the fittest—commercially this is not an economic practice. The object should not be a thoughtless imitation of nature's methods but an adaptation of them in order to increase the monetary return. The adoption of nature's methods from the poultryman's point of view is to rear by methods that give the chicks a fair chance. The poultryman should do the culling, not left to nature's method, which does not yield an economical return. Culling by the poultryman who knows the job does shew some return and this is one of the secrets of success in poultry farming—making the most of all birds reared, either for egg production or table, but breeding only from a selected few.

The chicks' rearing period involves a gradual change in accommodation, each stage designed to allow for development and the young stock's requirements at the various stages of growth, from a month to five or six weeks old, when they are ready for transfer from the brooder according to prevailing weather conditions, the chicks should be given the necessary protection and for their size they require also more room and increased ventilation at night. It is best to have an intermediate stage between the brooder and laying house. The design of the intermediate accommodation to adopt depends upon circumstances. There are several suitable types adaptable to various conditions, as, for example, under farm conditions where land is plentiful, the small movable colony house or fixed house may be regarded as the best proposition. The portable types are useful because they are economical and adaptable for use not only in enclosures for a few weeks but when the birds reach the age of three months they can be moved to larger range. The growing stock must be supplied with their entire requirements in regard to food irrespective of what they are able to find under veld conditions.

Ducks. The normal breeding season for ducks and geese is during the spring months and from about September their production is at its seasonal height. Early incubation of ducklings for egg production may be arranged to commence during June or July. Spring hatching is mainly confined to heavy breeds to meet the Xmas demand for table purposes. The main breeding season for ducks may extend from June to December. Artificial incubation and rearing is satisfactory on a large scale; hens or the Muscovy duck should be used when the natural system is adopted.

The incubation period of fertile eggs of the domestic duck is 28 days and that of the Muscovy 35 days. The domestic varieties of duck rarely sit, and unless an incubator is used eggs are mostly hatched by hens. Eggs for incubation should be stored in a cool place, high temperatures and draughty positions should be avoided. Ducklings must have shade in the hot weather. The principal part of the duck's ration is fed as a crumbly moist mash. The mash for breeding ducks may consist of one-third of its bulk in cut up green food.

Turkeys. The hatching of turkeys should proceed satisfactorily from this and next month and carried on until the end of the dry season. See that they have plenty of chopped onion tops or eschalots, and thick separated milk is beneficial. The poults should be started in the same way as chicks, that is, they should be allowed to rest in the incubator (or under the hen) for a day after hatching to gain strength, after which they can be moved to the brooding quarters. They should be fed the same whether the natural or artificial system of brooding is employed, on dry mash and grain. The starting mash for poults should contain about 25% of protein food for at least six to eight weeks. The mash should be fed in non-waste hoppers suitably arranged to avoid contamination of the food.

Guineafowl. Like partridge and most other wild birds, guinea fowls in the wild state mate in pairs, and this tendency is maintained under domesticated conditions also, provided the males and females are equal in number. As the breeding season approaches (September) one pair after another separates from the remainder of the flock and ranges off in the fields in search of a suitable nesting place. Once mated in this way, the male usually remains with his mate throughout the laying season, standing guard somewhere near the nest while the hen is laying and ready to warn her of any approaching danger. Under domestic conditions it is not necessary to mate them in pairs to secure fertile eggs. One male could be provided with three or four females. If the number of males predominates, continual fighting will be the result, and surplus hens are usually noisy. When mated in greater numbers than pairs, the hens are more likely to lay nearer home and several lay in the same nest.

Guinea fowl are provided with the best breeding conditions when they are allowed free range.

Rhodesian Milk Records.

OFFICIAL MILK RECORDS.

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Matopo Olive	Red Poll	Mature	5529.20	205.87	3.74	300	Govt. Experimental Station, Bulawayo
Jewel's Crystal of Greyville	Guernsey	4 years	7969.00	375.83	4.72	300	E. J. Hards, Churchill Farm, Marandellas.
Molly's Lady Moore of Wanganella ...	Guernsey	Mature	5678.00	260.51	4.59	270	
Mignonette's Blossom of Wanganella	Guernsey	Mature	6722.00	329.89	4.91	300	
Criterion Eerste I.	Friesland	2 years	12483.00	457.43	3.66	300	J. Jamieson, Box 217, Bulawayo.
Albertvale Spinekop XIII.	Friesland	Mature	11481.00	466.51	4 95	300	
Whinburn Angela	Friesland	2 years	8719.40	316.10	3.63	300	
Whinburn Chocolate...	Friesland	Mature	10554.20	360.75	3.42	300	
Whinburn Answer	Friesland	2 years	9766.50	336 29	3.44	300	
Whinburn Ariel ...	Friesland	Junior 3 yrs.	8944.00	331.58	3.71	300	
Bauhinia Ruth	Friesland	2 years	4474.50	186.41	4.17	300	T. C. Pascoe, Crowborough, Box 1253, Salisbury.
Crowborough Babs	Friesland	2 years	4474.00	166.37	3.72	300	

SEMI-OFFICIAL MILK RECORDS.

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Banzi...	G. Friesland	4 years	5698.70	247.69	4.35	300	D. A. Allan, P.O. Avondale.
Zindoro	G. Friesland	4 years	7871.50	308 24	3.92	300	
Chidsuku...	G. Red Poll	Mature	5466.70	233.14	4.26	300	
Bedouin	G. Friesland	4 years	6051 00	232.41	3.84	294	R. A. Ballantyne, Box 801, Salisbury.
Ringes II.	G. Friesland	Mature	7139.10	272.75	3.83	300	J. A. Baxter, Box 1368, Salisbury
Joseph...	G. Friesland	Mature	5594.90	242.34	4.33	300	
Chia	G. Friesland	Mature	7130.10	273.99	3.84	276	

France...	G. Friesland	Mature	7308.60	276.55	3.78	289	J. A. Baxter, Box 1368, Salisbury.
Moffat...	G. Friesland	Mature	7082.00	232.46	3.28	300	
Chemite	G. Friesland	Mature	5883.20	230.96	3.93	263	
Dick	G. Friesland	Mature	8423.10	290.02	3.44	300	
Mbandi	G. Friesland	Mature	8856.20	300.41	3.39	300	
Mutero	G. Friesland	Mature	7428.90	232.75	4.36	300	
Rita	G. Friesland	Mature	7575.30	310.16	4.09	300	J. R. Bedford, Poltimore, Marandellas
Katie II.	G. Friesland	Mature	7202.20	252.10	3 50	300	Mrs. M. Black, Burnisde, Bindura.
Jutice II.	G. Friesland	3 years	6465.80	233.13	3.61	300	
Laura	G. Friesland	Mature	7783.00	242.12	3.11	252	C. Boyd Clark, Castle Zonga, Inyazura
No. 151...	G. Friesland	Mature	6808.00	233.15	3.42	264	
No. 188...	G. Friesland	Mature	8056.00	283.24	3.52	300	
No. 198...	G. Friesland	Mature	6696.00	252.70	3.77	274	
Dainty AI	P.B. Friesland ...	4 years	7840.70	279.97	3.57	274	D. L. Comeran, Lochiel, Fort Victoria.
Mitchlin Dainty C.	P.B. Friesland ...	Mature	7725.70	254.40	3.29	300	
Mitchlin Dorina AI	P.B. Friesland ...	4 years	7653.00	281.37	3.68	300	
Alice	G. Hereford	Mature	7186.50	300.81	4.19	293	L. E. O. Cary. Clovelly, Trelawney.
Ruby	G. Ayrshire	Mature	6593.00	231.41	3.51	284	
Polly	G. Ayrshire	Mature	7119.50	277.07	3.89	300	
Esinati Leon	G. Friesland	4 years	7427.00	270.29	3.64	300	J. Cumming, Hillside, Norton.
Mnyati	G. Friesland	Mature	6638.00	263.14	3.96	229	
Pillow I....	G. Friesland	Mature	8800.00	292.88	3.32	300	A. C. De Olano, Bluewaters, Bromley.
Miriam	G. Friesland	Mature	8045.00	241.93	3.02	300	
Nan	G. Friesland	Mature	9498.00	310.19	3.27	300	
No. 155	G. Friesland	Mature	7569.50	259.44	3.43	300	J. B. Dold, Box 1153, Salisbury.
A76	G. Friesland	Mature	7018.10	234.56	3.34	300	
Dirko Dinsdag ...	P.B. Friesland ...	Mature	6634.00	267.38	4.03	238	Mrs. M. Everard, Castle Zonga, Inyazura.
Signora II....	G. Friesland	Mature	9012.00	349.93	3.88	300	
No. 164	G. Friesland	Mature	6575.00	274.35	4.17	296	
No. 43	G. Friesland	4 years	8417.00	271.77	3.23	300	H. C. Fischer, Olivia Farm, Headlands
No. 204	G. Friesland	Mature	10118.50	328.25	3.24	300	
No. 213	G. Friesland	Mature	8474.00	286.37	3.38	291	
No. 225C	G. Friesland	Mature	7642.50	257.22	3.37	251	
No. 246	G. Friesland	Mature	8042.50	271.11	3.37	266	

SEMI-OFFICIAL.—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
No. 99	G. Friesland	3 years	9058.00	316.36	3.49	300	R. le S Fischer, Wakefield, Headlands
No. 98	G. Friesland	3 years	10273 00	363.98	3.54	300	
No. 50	G. Friesland	4 years	11576.00	363 38	3.14	273	
No. 93	G. Friesland	5 years	10969.00	368.77	3 36	300	
No. 160...	G. Friesland	Mature	9645.00	360.76	3.74	300	
No. 2A	G. Friesland	Mature	8056.00	301.20	3 74	300	W. F. Fischer, Coldstream, Headlands
No. 440	G. Friesland	Mature	5657.00	245.13	4.33	290	
No. 430...	G. Friesland	Mature	8032 50	269.89	3.36	300	
No. 483...	G. Friesland	Mature	7173.50	235.23	3 28	261	
No. 414...	G. Friesland	Mature	7627 50	297.28	3 90	300	
No. 468...	G. Friesland	Mature	6689.50	261.68	3.91	300	
No. 443...	G. Friesland	Mature	7129.50	278.94	3.91	293	
No. 525...	G. Friesland	3 years	7278.50	265.12	3.64	300	
No. 289...	G. Friesland	Mature	6874.50	269.71	3.92	300	
No. 325...	G. Friesland	Mature	10265 00	332.91	3 24	300	
No. 304...	G. Friesland	Mature	7696.00	262.32	3.41	294	
Nelly	G. Friesland	2 years	4340.70	228.42	5 26	300	G J. Franklin & Son, Box 105, Umtali
Nanny...	G. Friesland	2 years	4383.20	226 18	4.63	300	
Nutmeg	G. Friesland	Mature	8500.50	370.85	4 36	300	
Sheila	G. Guernsey	Mature	6441 80	280.56	4.35	300	
Cherry	G. Friesland	Mature	9234.10	374.73	4.06	300	
Bokkie II.	G. Friesland	Mature	8310 30	340.92	4.12	300	
Tokidai	G. Friesland	Mature	6793.00	266.05	3 92	300	
Shimba Tambo ...	G. Friesland	Mature	6804.40	283.21	4.15	300	
June	G. Friesland	Mature	8670 70	346.68	4.00	300	
Kuleba	G. Friesland	Mature	6431.90	259.97	4.04	300	
Mpunzi	G. Common	Mature	12342 90	512.11	4 15	300	
Mplatte III.	G. Friesland	Mature	8499.70	338.52	4.03	285	
Julia	G. Friesland	4 years	8131.50	287.41	3 51	300	P. Freeland, Lingfield, P.O. Gwelo.
No. 193 (Lulu)	G. Friesland	4 years	6521.70	234.06	3 59	300	
Sussannah	G. Friesland	Mature	7620.40	254.28	3 34	300	
No. 19	G. Friesland	3 years	6518 90	232.52	3.57	300	
Blackface	G. Friesland	3 years	5677.70	251.29	4.43	300	G. G. Futter, Marjoribanks, P.O. Gwelo

No. 99	G. Friesland	Mature	6688.20	253.75	3.79	300	W. N. Gebbie, P/B 19A, Salisbury.
No. 146...	G. Friesland	Mature	5710.10	230.37	4 03	300	
No. 77	G. Friesland	Mature	5655.30	230.65	4.08	300	
No. 128...	G. Friesland	Mature	6627.00	239.39	3.61	300	
Lysander...	G. Friesland	Mature	6165.50	279.53	3.42	267	Gwebie Government Farm, P.B. 76B, Salisbury.
Mustang	G. Friesland	Mature	6647.00	228.60	3.44	281	
Mosquito	G. Friesland	Mature	8745.50	305.31	3.49	300	
Seafiire	G. Friesland	Mature	6755.00	261.36	3.87	232	
Carla	G. Friesland	Mature	8497.00	310.04	3.65	300	Hon. H. V. Gibbs, Bonisa, Redbank, P.B. 52L, Bulawayo.
Fanny	G. Friesland	Mature	10077.00	347.33	3.45	300	
Linda	G. Friesland	Mature	10350.00	378.08	3.65	300	
Marion...	G. Friesland	Mature	8129.50	281.21	3.46	259	
Penny	G. Friesland	Mature	6439 00	225.37	3.50	254	
Sally	G. Friesland	Mature	9407.00	301.63	3.21	300	
Sandra	G. Friesland	Mature	8197.00	286.05	3.50	280	
No. 112...	G. Red Poll	Mature	8928.10	332.01	3.72	300	Government Experimental Station, P.B. K19, Bulawayo.
No. 139...	G. Red Poll	Mature	7497.90	280.58	3.74	250	
No. 145...	G. Red Poll	Mature	7391.10	264.36	3.58	299	
No. 3	G. Friesland	Mature	12105.40	472.72	3.91	273	Grassland Experimental Station, Marandellas.
No. 11	G. Friesland	Mature	10888.30	400 23	3 67	287	
No. 27	G. Friesland	Mature	11751.10	424.24	3.61	300	
No. 57	G. Friesland	3 years	9361.10	362.50	3.87	284	
No. 58	G. Friesland	3 years	7579.30	308.25	4.07	300	
No. 7	G. Friesland	Mature	11367.00	420.37	3.70	271	
No. 19	G. Friesland	Mature	8944.00	337.91	3.78	300	
Lydia	G. Friesland	Mature	9713.50	363.43	3.74	300	Mrs. C. Harrison, Box 58, Shamva.
Whisky	G. Friesland	Mature	8900 10	303.85	3.41	300	D. J. Huddy, Box 718, Salisbury.
Buttercup	G. Friesland	Mature	9128.80	335.96	3.68	300	
Flash	G. Friesland	2 years	6303.90	225.22	3.57	300	
Waaf	G. Friesland	Mature	7160.70	244.96	3.42	300	
Rosella	G. Friesland	Mature	10210.00	372.45	3.65	272	
Intombi	G. Friesland	Mature	8595.80	330.50	3 84	284	
Rosebud	G. Friesland	Mature	6989.40	225.23	3.22	262	
Bess	G. Friesland	2 years	6874.10	258.25	3.76	300	Sir G. M. Huggins, Box 671, Salisbury
J.17	G. Friesland	Mature	11857.00	482.35	4.07	300	J. Jamieson, Box 217, Bulawayo.
J.49/1	G. Friesland	2 years	6938.00	240.87	3.47	300	
J.56/2	G. Friesland	3 years	14772.00	555.86	3.76	300	

SEMI-OFFICIAL—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
J.57/1/1	G. Friesland	2 years	7490 00	292.89	3 91	300	J. Jamieson, Box 217, Bulawayo.
J.J.66/2	G. Friesland	4 years	13762.00	488.45	3.55	300	
J.74/1	G. Friesland	Mature	11359.00	387.31	3.27	300	
J.94/1/1	G. Friesland	2 years	6079.00	235.49	3.87	300	
No. 8	G. Friesland	Mature	6489.00	250.45	3.86	254	D. S. Kabot, Box 261, Bulawayo.
No. 12	G. Friesland	Mature	8343.00	358.39	4.30	300	
No. 18	G. Friesland	Mature	7011.00	261.67	3.73	300	
No. 19	G. Friesland	Mature	13716.00	512 83	3.74	300	
No. 41	G. Friesland	Mature	11413.00	392.09	3.44	300	
No. 51	G. Friesland	Mature	10317.00	369.79	3.59	300	
No. 55	G. Friesland	Mature	13649.00	498.08	3.65	300	
No. 61	G. Friesland	Mature	10261.00	338.42	3.30	300	
No. 62	G. Friesland	Mature	8673.00	303.85	3 50	300	
No. 68	G. Friesland	Mature	5580.00	248.09	4.44	265	
No. 72	G. Friesland	Mature	9191.00	296.85	3.20	300	
No. 82	G. Friesland	Mature	6756.00	260.82	3.87	300	
No. 87	G. Friesland	Mature	8480 00	322.69	3.81	274	
No. 88	G. Friesland	Mature	8805.00	320.50	3 64	300	
Tib	G. Friesland	Mature	6793.40	234.30	3.45	231	D. King, Rockwood Farm, Concession.
Nan	G. Friesland	4 years	6635.80	236.56	3.56	214	
Marina	G. Friesland	Mature	6001.80	233.06	3.88	287	
Jane...	G. Friesland	Mature	7196.70	229.01	3.18	300	Mrs. M. M. Krahner, Haydock Park, Banket.
Pumpkin	G. Friesland	Mature	7641.60	252.34	3.30	300	
Jeanne	G. Friesland	Mature	6838.70	228.50	3 34	300	
Whinburn Argosy	P.B. Friesland ...	2 years	5691.00	230.57	4.05	300	J. N. L. McIlwaine, Box 23, Marandellas.
Kitty	G. Friesland	3 years	6006.10	233.58	3.79	300	C. J. Marshall, Box 654, Bulawayo.
No. 13	G. Friesland	Mature	7618.00	244.86	3.21	300	D. W. Marshall, Box 164, Umtali.
Lelia	G. Jersey	Mature	5020.50	241.08	4 80	255	Lt.-Col. Maynard, P.B. 112C, Salisbury.
No. 41	G. Friesland	Mature	7219.30	285.78	3.96	300	J. U. McCay, P.B. J181, Bulawayo.
No. 11	G. Friesland	Mature	8905.00	288.66	3.25	300	

G.26/0	G. Friesland	Mature	7280.00	273.08	3.75	300	Meikles Trust & Invest. Co., Leachdale Farm, Shangani.
G.14/2	G. Friesland	3 years	8440.00	348.75	4.13	300	
Model	G. Lincoln Red...	Mature	5774.00	225.21	3.90	300	C. F. Mitchell, Manzana, Box 1027, Bulawayo.
Dignity BII. A. ...	P.B. Friesland ...	4 years	11617.00	371.08	3.19	300	W. S. Mitchell, Spring Farm, Iron Mine Hill.
Mitchlin Liberty ...	P.B. Friesland ...	Mature	9550.50	357.95	3.75	300	
Mitchlin Prudence B.	P.B. Friesland ...	4 years	8746.50	300.88	3.44	300	
Mitchlin Dignity DI.	P.B. Friesland ...	3 years	7604.00	236.96	3.12	300	
Mitchlin Delina's Amelia	P.B. Friesland ...	3 years	7015.00	241.34	3.44	300	
Molly of Tolosa ...	P.B. Friesland ...	Mature	8276.00	252.89	3.06	300	F. B. Morrisby, Sunnyside Farm, Box 36, Gwelo.
No. 29	G. Friesland	Mature	8096.00	259.22	3.20	300	
No. 85	G. Friesland	Mature	9337.00	286.14	3 06	300	
No. 88	G. Friesland	Mature	9294.00	282.56	3.04	300	
No. 97	G. Friesland	Mature	9262.00	281.42	3.04	300	
No. 109...	G. Friesland	Mature	8235.00	271.04	3.29	300	
No. 126...	G. Friesland	Mature	10135.00	315.02	3.11	300	
No. 139...	G. Friesland	Mature	8128.00	244.84	3.01	300	
No. 140...	G. Friesland	Mature	8351.00	259.78	3 11	300	
No. 143...	G. Friesland	Mature	8721.00	270.49	3.10	300	
No. 149...	G. Friesland	Mature	7749.00	268.12	3.46	300	
No. 155...	G. Friesland	4 years	7130.00	242.40	3.40	300	
No. 157...	G. Friesland	4 years	9087.00	298.63	3.29	300	
No. 161...	G. Friesland	4 years	7552.00	256.42	3.40	300	
Grootschuur Gwynne	Reg. Shorthorn ..	Mature	6554.50	270.46	4.13	300	F. Muggleton, Steynstroom, Umtali.
Grootschuur Sweetheart	Reg. Shorthorn ..	Mature	5833.00	235.98	4.04	260	
Mona	G. Shorthorn... ...	Mature	5851.50	242.53	4.14	273	
Betty	G. Friesland	Mature	5247.40	235.30	4.48	300	J. T. Mungle, Myrside, Odzi.
Bessie	G. Friesland	Mature	6540.00	248.45	3.80	300	
Jenehuma	G. Friesland	Mature	7366 80	245.26	3.33	300	
Petal	G. Friesland	Mature	8630.40	350.59	4 06	282	E. Palmer, Ferndale, Penhalonga.
Blackie	G. Shorthorn... ...	Mature	7296.10	303.41	4.16	270	
Bell II.	G. Friesland	3 years	5814.30	253.20	4.35	290	
Queenie	G. Friesland	Mature	9977.90	345.96	3.47	280	

SEMI-OFFICIAL—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner
No. 46	G. Friesland	Mature	8320.10	332.23	3.57	300	T. C. Pascoe, Crowborough, Box 1253, Salisbury.
No. 117...	G. Friesland	4 years	7070.30	288.18	4.08	295	
No. 118...	G. Friesland	4 years	10381.20	361.81	3.49	300	
No. 120...	G. Friesland	4 years	7090.30	246.21	3.47	300	
No. 126...	G. Friesland	Mature	7164.70	270.26	3.77	300	
No. 127...	G. Friesland	3 years	5690.40	225.19	3.96	300	
No. 132...	G. Friesland	Mature	6176.60	290.17	4.70	263	
Lucia	G. Friesland	Mature	6634.80	241.99	3.64	282	Red Valley Estate, Lushington, Marandellas.
Betsy	G. Friesland	Mature	7908.30	305.59	3.86	276	
Delia	G. Friesland	Mature	6029.00	266.04	4.41	300	Rhod. Corp., Ltd., Kent Estate, Norton
Liva	G. Friesland	3 years	8081.50	374.36	4.63	300	W. F. H. Scutt, Maple Leaf, Norton.
Avurundiya...	G. Friesland	Mature	7542.00	249.54	3.31	287	
G8	G. Ayrshire	Mature	7101.00	248.95	3.51	300	J. R. Stewart & Son, Battle Farm, Shangani.
P17	P.B. Ayrshire ...	Mature	7555.00	299.21	3.96	300	
Apanamoney	G. Friesland	Mature	7347.00	284.90	3.88	300	E. Tapson Trust Ltd., Lesape Falls, Rusape.
Bucket...	G. Friesland	4 years	7041.00	251.48	3.57	300	
Bunny	G. Friesland	Mature	7003.00	264.51	3.78	300	
Debula...	G. Friesland	Mature	6502.00	233.25	3.59	300	
Funny	G. Ayrshire	Mature	8280.00	299.72	3.62	300	
Gatooma	G. Friesland	Mature	9419.00	364.16	3.87	300	
Graniata	G. Friesland	Mature	7253.00	243.15	3.35	300	
Headlands	G. Friesland	3 years	7402.00	266.04	3.59	300	
Kanawet	G. Ayrshire	Mature	7312.00	262.41	3.59	300	
Maxim...	G. Ayrshire	Mature	9391.00	328.95	3.50	300	
Tshabani	G. Friesland	Mature	8205.00	281.81	3.43	300	

Gertie	G. Friesland	Mature	6482.30	264.38	4.08	292	A. W. Tennent, Kelvin, Headlands.
Wendy...	G. Friesland	Mature	6439.20	241.70	3.75	300	
Agrin	G. Red Poll	Mature	6140.60	246.08	4.00	300	J. G. Thurlow, Atherstone, Bindura.
Dorika...	G. Friesland	Mature	7603.00	313.18	4.12	300	
Matapikis	G. Jersey	Mature	6388.60	265.35	4.15	300	
Juno	G. Red Poll	Mature	6046.20	245.01	4.05	300	
Leggis	G. Friesland	Mature	6643.00	256.78	3.86	300	
Mangashu	G. Red Poll	Mature	6021.00	250.52	4.16	300	
Marandellas	G. Red Poll	Mature	7885.60	296.41	3.51	300	
Nyama...	G. Red Poll	Mature	7207.40	269.01	3.73	300	
Petrol I.	G. Friesland	Mature	5986.60	251.51	4.22	300	R. Thwaites Stow, Marandellas.
Spotty...	G. Friesland	Mature	5610.00	239.93	4.28	258	P. S. Timms, Chitora, Rusape.
Kelpie	G. Friesland	3 years	6629 00	229.08	3.46	300	W. E. Tongue, Box 199, Bulawayo.
Sabina...	G. Friesland	Mature	14513.00	476.65	3.28	300	
B.B....	G. Africander ...	4 years	5151.40	270 31	5.25	284	C. G. Trasey, Handley Cross, Gatooma
Hans	G. Friesland	Mature	7448.80	301.16	4.04	300	
No. 99	G. Red Poll	Mature	6402.50	232.11	3.62	245	A. M. Tredgold, P.B. 61L, Bulawayo.
No. 165...	G. Red Poll	Mature	8537.50	327.32	3.81	300	
No. 199..	G. Red Poll	Mature	5113.50	243.38	3.76	300	
Cinderella	G. Friesland	4 years	6688.50	256.65	3 84	300	Miss I. van Niekerk, Claremont, Inyanga, P.B. Rusape.
Verna...	G. Friesland	Mature	6876.00	261.32	3.80	277	
No. 125...	G. Friesland	3 years	7756.00	256.26	3.30	300	R. O. Waldschutzmere, Marandellas.
Bessie...	G. Red Poll	4 years	5936.80	241.42	4.07	300	N. W. Whitehead, Lonsdale Farm, P.O. Matopos.
M'Godeni	G. South Devon...	Mature	5250.50	240.99	4.59	300	
Polly	G. Red Poll	4 years	5550.30	232.56	4.19	300	

Southern Rhodesia Veterinary Report.

JUNE, 1947.

General. Cattle have not fallen off as much as was expected this month; in fact, the condition is just as good in most areas as it was last month, due, no doubt, in a large extent to the mild weather. Reports even from Drought-Stricken Areas state that many of the cattle are in better condition than they were this time last year; and if only water was obtainable the grazing would probably hold out. It is very evident that over the whole country only a small rainfall is necessary to produce the best grazing, and if water could be procured a future drought should not be greatly feared. 1,490 Drought Relief Cattle were moved to the Salisbury Area and were then distributed.

Tick Life is not much in evidence.

Diseases: African Coast Fever. Chipinga and Melsetter Districts: No deaths were recorded on any of the infected farms and no extensions of disease were diagnosed. Unfortunately owing to the falling off in condition of the cattle, the dipping interval on all farms except one has had to be extended to seven days, with intermediate hand dressing.

At the Riet Vlei tank, where dipping is being carried out in Gamatox No 2 dip at three-day intervals, the cattle are in better condition than at most of the other tanks.

Salisbury District: No further cases have been diagnosed on Highlands Farm. Here Gamatox No. 2 is also being used at three-day intervals with satisfactory results.

Anthrax. No outbreaks have been reported during the month.

Trypanosomiasis. Five cases were diagnosed in the Chipinga Area.

Lumpy Skin Disease. A few mild cases were reported in Gwelo and Fort Victoria Areas. No further cases were recorded in Salisbury and the infected farms have been removed from quarantine.

Theileriosis. No cases have been reported.

Piroplasmosis. Twenty-one cases were recorded.

Anoplasmosis. Thirty-four cases were recorded.

Quarter-Evil. Twenty-five outbreaks were diagnosed with a small mortality.

Mallein Testing. One hundred and thirty-one horses were tested with negative results.

Tuberculin Testing. Thirty bulls, ninety-nine cows, ninety-eight heifers and two yearlings were tested with negative results.

IMPORTATIONS.

Union of South Africa: 17 horses and mares, 103 geldings, 197 cows and calves (breeding), 34 bulls (breeding), 52 sheep (slaughter).

EXPORTATIONS.

Union of South Africa: 2 geldings.

Northern Rhodesia: 1,315 oxen (slaughter), 2,023 cows (slaughter), 435 sheep (slaughter), 63 donkeys, 3 bulls (breeding).

Portuguese East Africa: 145 oxen (slaughter), 12 cows (slaughter), 2 oxen (trek).

Belgian Congo: 4 geldings.

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage.

United Kingdom: Beef, 130,150 lbs.; bacon, 56,059 lbs.

Union of South Africa: Beef, 21,437 lbs.; ham, 7,495 lbs.; sausages, 1,306 lbs.; fats, 5,626 lbs.; sausage casings, 35,080 lbs.

Bechuanaland Protectorate: Beef, 2,885 lbs.; bacon, 332 lbs.; ham, 75 lbs.; sausages, 397 lbs.; fats, 750 lbs.; offal, 301 lbs.

Northern Rhodesia: Beef, 93,302 lbs.; bacon, 23,010 lbs.; sausage, 5,519 lbs.; fats, 19,540 lbs.; offal, 7,808 lbs.; veal, 1,224 lbs.; pork, 4,950 lbs.; sausage casings, 42 lbs.

Portuguese East Africa: Beef, 27,358 lbs.; fats, 4,352 lbs.; offal, 483 lbs.; mutton, 12,860 lbs.

Belgian Congo: Beef, 142,751 lbs.; bacon, 965 lbs.; ham, 4,141 lbs.; sausages, 50 lbs.; offal, 17,929 lbs.; veal, 4,129 lbs.; poultry, 224 lbs.; mutton, 385 lbs.

Meat Products from Liebig's (Rhodesia), Ltd., West Nicholson.

Union of South Africa: Corned beef, 368,820 lbs.; Vienna sausages, 31,125 lbs.; luncheon roll, 17,876 lbs.; Ideal quick lunch, 7,200 lbs.; corned beef, 8,280 lbs.; sweetcorn, 7,508 lbs.

Belgian Congo: Corned beef, 10,800 lbs.

P. D. HUSTON,

Chief Veterinary Surgeon.

JULY, 1947.

General. Owing to a considerable cold spell and several severe frosts, grazing has been affected and the condition of the cattle is rapidly falling off. This falling off is most noticeable in drought cattle moved to Mashonaland; 952 were destroyed during the month.

Tick Life is not active.

Diseases. African Coast Fever. Melsetter and Chipinga. No deaths from this disease have been diagnosed during the month. Although dipping is only being carried out weekly, on inspection by me during the month, no ticks could be found on any of the infected herds.

Salisbury District. No further cases have occurred on the farm "Highlands."

Anthrax. One case was diagnosed on the farm "Komani" and 310 head were inoculated without any further mortality.

Trypanosomiasis. No cases reported.

Lumpy Skin Disease. Only a few mild cases in Gwelo and Fort Victoria areas.

Theileriosis. No cases.

Piroplasmosis. Thirty-seven cases diagnosed.

Anoplasmo is. Forty-five cases diagnosed.

Quarter Evil. Thirty-eight outbreaks were dealt with by inoculation.

Strangles. Some 32 cases were treated amongst horses in Salisbury District.

Mallein Test. Sixty-seven horses and six mules were tested with negative results.

Tuberculin Testing. Twenty-nine bulls, 45 cows and 103 heifers were tested with negative results.

IMPORTATIONS.

Union of South Africa: 31 bulls (breeding), 147 cows (breeding), 6 mules, 61 geldings, 5 horses and mares, 12 pigs (breeding), 260 sheep (slaughter), 9 cows (slaughter), 27 oxen (slaughter), 1 bull (slaughter).

EXPORTATIONS.

Northern Rhodesia: 993 oxen (slaughter), 42 bulls (slaughter), 1,548 cows (slaughter), 3 bulls (breeding), 9 geldings, 436 sheep (slaughter), 36 donkeys, 2 pigs (breeding).

Portuguese East Africa: 141 oxen (slaughter), 20 cows (breeding), 14 bulls (breeding).

Belgian Congo: 11 geldings, 45 sheep (slaughter), 7 donkeys.

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage.

United Kingdom: Beef 471,060 lbs., bacon 103,650 lbs.

Union of South Africa: Beef 200,016 lbs., ham 224 lbs., fats 25,841 lbs., sausage casings 2,924 lbs.

Bechuanaland Protectorate: Beef 3,257 lbs., bacon 260 lbs., ham 97 lbs., sausages 305 lbs., fats 120 lbs., offal 242 lbs., brawn 23 lbs.

Northern Rhodesia: Beef 81,234 lbs., bacon 25,430 lbs., ham 4,364 lbs., sausages 853 lbs., fats 5,822 lbs., offal 6,011 lbs., veal 564 lbs., pork 5,870 lbs.

Belgian Congo: Beef 222,479 lbs., bacon 794 lbs., ham 3,087 lbs., sausages 50 lbs., offal 22,670 lbs., veal 5,034 lbs., poultry 387 lbs., mutton 1,077 lbs., sausage casings 1,667 lbs.

Meat Products from Liebigs (Rhodesia) Ltd., West Nicholson.

Union of South Africa: Luncheon roll 6,464 lbs., corned beef 157,140 lbs., ox tongues 396 lbs., Oxford sausages 288 lbs., Vienna sausages 675 lbs., steak and kidney 1,560 lbs., curried beef 1,560 lbs., pate de foie 2,755 lbs., beef dripping 11,550 lbs.

SOUTHERN RHODESIA

Locust Invasion, 1932-47.

Monthly Report No. 176: July, 1947.

Red Locust: *Nomadacris septemfasciata Serv.*

No reports of locusts in any stage of development within the Colony were received.

J. K. CHORLEY,
Chief Entomologist.

Monthly Report No. 177: August, 1947.

Red Locust: *Nomadacris septemfasciata Serv.*

No reports of locusts in any stage of development within the Colony were received.

J. K. CHORLEY,
Chief Entomologist.

THE RHODESIA

Agricultural Journal

Vol. XLIV. No. 6 November-December, 1947.

Editorial

Notes and Comments

LONGEVITY OF BAMBOO SEED.

"Tropical Agriculture," Vol. XXIV., 4-6, 1947, contains an account of experiments carried out by the Dept. of Agriculture, Mayaguez, Puerto Rico, on the longevity of bamboo seed under different conditions.

Bamboos grown from seed flower and fruit at intervals of from 20 to 80 years.

In February-March, 1945, and again in 1946, many clumps of *Bambusa arundinacea* Retz flowered and fruited on the station grounds. While it is realised that the economic value of this species is small it is considered that the results of the experiments would also apply to other bamboo species.

The 1945 seed (except for two samples) was sealed in quart fruit jars containing granular calcium chloride at the foot of the jars. This layer of drying agent was covered with one inch of cotton batting and the samples of bamboo seed were tied in cheese-cloth bags and placed on top of the cotton. The samples were then exposed to 4 temperature ranges.

(a) Room temp. 70°F.-90°F.

(b) Controlled temp. of 70°F.-80°F.

(c) Temperature of 60°F.-70°F.

(d) Temperature of 50°F.

In addition one sample was kept at room temperature in a dessicator over potassium pyrogallate solution which absorbed oxygen and carbon dioxide. Yet another sample was stored at room temperature in an open fruit jar. The moisture content of the seed averaged 18 per cent.

Germination tests were carried out from time to time with 100 seeds. Germination took place under room conditions on filter paper placed on moist sphagnum moss in petre dishes.

The seed stored over calcium chloride showed no appreciable decrease in germination after 202 days, except the batch stored at 70°F.-80°F., but the seed stored over potassium pyrogallate and the control showed a marked falling off in viability after 108 days and no seed germinated at all after 202 days storage.

The 1946 seed was also stored in fruit jars except one lot which was placed in a dessicator over potassium pyrogallate. Hydrated lime and powdered charcoal were used in addition to calcium chloride as drying agents. For controls one sample of seed was exposed and another sealed tightly in a jar without a drying agent. The average moisture content was 23 per cent. Half of each sample was dried in an oven to a moisture content of 12 per cent. Samples were then taken from the seeds at 23 per cent. moisture content and at 12 per cent. moisture content, and exposed to room temperatures from 70-90°F. and in a refrigerator at a temperature of 44-50°F., while the control seed and the seed stored over potassium pyrogallate were exposed to room temperature only. The initial germination of oven dried seed averaged 79 per cent., and that of not dried 88 per cent.

After 72 days' storage the seed not oven dried had a higher percentage of germination than the dried seed but the difference was slight. After 148 days the seed stored at room temperature over hydrated lime, potassium pyrogallate, and sealed in jars without a drying agent did not germinate.

After 227 days the highest germination results were from seed stored at room temperature over calcium chloride. Under these conditions seed which had been dried germinated slightly better. Refrigeration of seed over hydrated lime and over charcoal increased longevity. A small percentage of seed of the control sample exposed to room conditions germinated after 227 days.

The most practical method then of preserving the viability of bamboo seed was storage over calcium chloride at room temperature, while storage over hydrated lime or charcoal under refrigeration was also good. If the seed was dried to give a moisture content of 12 per cent. it increased longevity. Where no drying agent was used, exposed seed kept the viability longer than the seed sealed airtight.

Bamboos can be propagated readily from seed. The seed was planted at a depth of ¼in. in a greenhouse. After two months the plants were 8 to 10ins., and were transplanted to gallon cans under partial shade. Eight months later they were 3 to 4ft. high with side branches and shoots. Six months later they had formed a dense hedge 10 to 12ft. high.

METHODS FOR STUDYING THE PHYSIOLOGICAL DISORDERS OF TREES IN THE FIELD

At East Malling Research Station, Kent, investigations were carried out to test the possibility of injecting individual fruits on a tree with a view to studying the effect of nutrient substances on fruits while still on the tree.

Method I. Injection of the Whole Fruit of Apple. A leafy shoot about 2in. long, growing on a spur bearing a fruit, was bent over and the cut end placed in a small container of dye solution. The rate of absorption was 10 ml. within two or three hours. The treated spurs were then removed and dissected in order to trace the course of the dye. The dye had permeated most of the spur system and a large amount of dye travelled into the bourse which bore the fruit. On cutting the fruit all the vascular bundles were dyed, but when there were two or more fruits on the same bourse then the fruit nearest to the injected shoot became fully injected while the other were only partially so, and on cutting open these fruits only one or two of the vascular bundles were stained.

Method II. Partial Injection of a Fruit. A fruit that had a secondary shoot arising adjacent to it on the same bourse was suitable. The shoot was bent and treated as in Method I. If the shoot was too short the injection was effected on the petiole of a leaf borne on it and the cut petiole bent over into a small container attached to the shoot by means of a band.

By this method it was found that the dye travelled into the bourse and straight up the apple stalk, while very little went into the main spur system. When more than one apple was on the same bourse the dye travelled to the fruit whose stalk was closest to the secondary shoot.

By these methods permeation occurred of one or two sectors of the fruit only and it is considered that the injection of nutrient solutions by these methods should be valuable in the study of physiological disorders of apple trees in the field.—("The Journal of Pomology and Horticultural Science, Vol. XXIII., Nos. 1 and 2, 1947.)

An Improved Implement for use in Compost-making

By J. D. SCOTT, in "Farming in South Africa."

This article is republished as it is thought it would be of interest to many farmers now making kraal compost.

In the making of compost at the Estcourt and Tabamhlope stations, all dry stock are fed in kraals during the winter to afford them maximum protection against cold. A fresh layer of bedding is added to the kraals each week or whenever required until, by the end of winter, a mixture of grass, dung and urine to a depth of a couple of feet is obtained. This is not touched during the winter as temperatures are too low and there is not enough moisture for much bacterial action.

At the end of winter the cattle return to the veld and, after the bedding in the kraals has been wetted thoroughly by rain, it is built up into heaps about 4 feet 6 inches high varying in width from 12 to 18 feet and in length from 25 to 60 feet. The removal of the material from the floor of the kraal has always been an expensive process. Turning by means of a plough has resulted in continual packing in front of the plough, and a dam scoop has always jumped. As a result the material has had to be removed by hand labour with forks and wheelbarrows which is slow and expensive.

This season an improvement to a dam scoop was tried with excellent results. Four iron bands 2 inches wide and ½ inch thick, sharpened to a point, were riveted under a dam scoop so that the two middle ones projected about 11¾ inches and the two outer ones 10 inches in front of the scoop, being just clear of the inside of the draw-bar. In addition to the rivets, the front edge of the scoop was welded to the bars so that there was no chance of material working between the bars and the scoop.

These sharpened bars penetrated the mixture on the kraal floor easily and it was possible for two boys to remove all the material, with two oxen drawing the dam scoop. As the passage

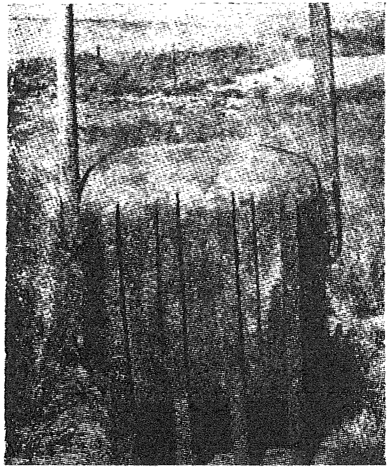


Fig. 1.—View of under-side of scoop. showing how the iron bars are riveted on.

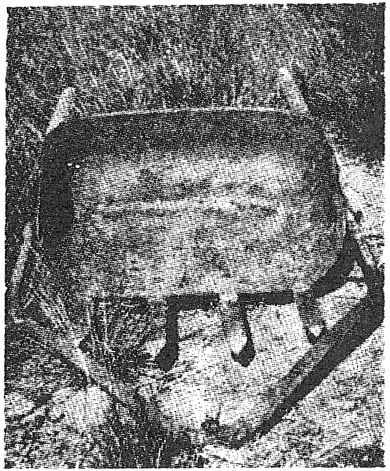


Fig. 2.—View of scoop from above. showing the position of the bars in relation to the draw-bar. Note welding of edge of scoop to the bars.

of the oxen over a heap would have consolidated it too much, the compost material was dumped outside the kraal where two other boys packed it into the heaps.

This improved implement has cut down the cost of compost-making at Estcourt enormously. Two boys with two big oxen in this scoop took the compost material out of the kraal at the rate of just under 19 tons per day (1 cu. yd. at 70 per cent. moisture weighs approximately $\frac{1}{2}$ ton) and, with two boys packing it into heaps, it was possible to build a stack 25 ft. x 18 ft. x $4\frac{1}{2}$ ft. high in two days.

The cost of effecting these improvements to the scoop (at the present high price of iron) is only a matter of about £2 10s., and this amount is easily saved in labour within the first few days. The bands riveted underneath act as shoes, taking all the wear and thus adding considerably to the life of the scoop.

Cattle Bale or Grip

By B. G. GUNDRY, Department of Irrigation, in co-operation with the Branch of Animal Husbandry.

A cattle bale or grip is essential to handle cattle efficiently when carrying out such operations as dosing, inoculation, branding, castration, dehorning, the treatment of wounds, etc. The alternative in the case of the more serious of these operations is often to throw the cattle, which is neither so speedy nor so hygienic.

The cattle grip at the Grassland Station, Marandellas, is in constant use and many farmers who have seen it have asked for plans from which to build it. It has, therefore, been decided to publish the explanatory diagram given here.

No originality is claimed for the design of this bale, the prototype of which was, it is believed, first developed locally by Mr. H. F. Gleadow, the Manager of the Central Estates Ranch, Umvuma.

The construction of the bale, which is clearly indicated in the accompanying drawing, is fairly simple, and not unduly expensive. The necessary ironwork might be made by a blacksmith or a handyman who has the necessary equipment for forging and drilling the various components. In the drawing all the timber is shown as cut from round poles of suitable native timber such as M'wanga, Knobthorn, Mopane or Gum, but old teak railway sleepers, if procurable, can be sawn to suitable rectangular sections and should prove very durable. In any case the inner faces of the two horizontal cross rails between which the jaws work should be sawn to present a smooth, flat surface.

The timber should be well seasoned, and if possible treated with a good non-poisonous preservative such as creosote or tar after all cutting has been completed.

The jaws may with advantage be made of 3 inch iron pipe since timber is liable to split at the bolt holes. To prevent this the extremities of the poles might be fitted with ferrules of 3½in. or 4in. piping or bands forged from flat iron about ¼in. thick and 2 or 3 inches wide.

The bolts used should be 1-16in. smaller than the diameter of the holes shown, and their length will depend largely on the size of timber used for the various components.

Umkuzanne

(*DICHAPETALUM CYMOSUM*).

By O. WEST, D.Sc., Pasture Research Officer.

A contribution from the Central Veld and Pasture Station for Matabeleland.

Introduction. *Dichapetalum cymosum* (Hook.) Engl. well known in Matabeleland by its Sindebele name umKouzaane and in the Transvaal as Gifblaar, is, according to Steyn(1), one of the most dangerous stock poisons on the sub-continent.

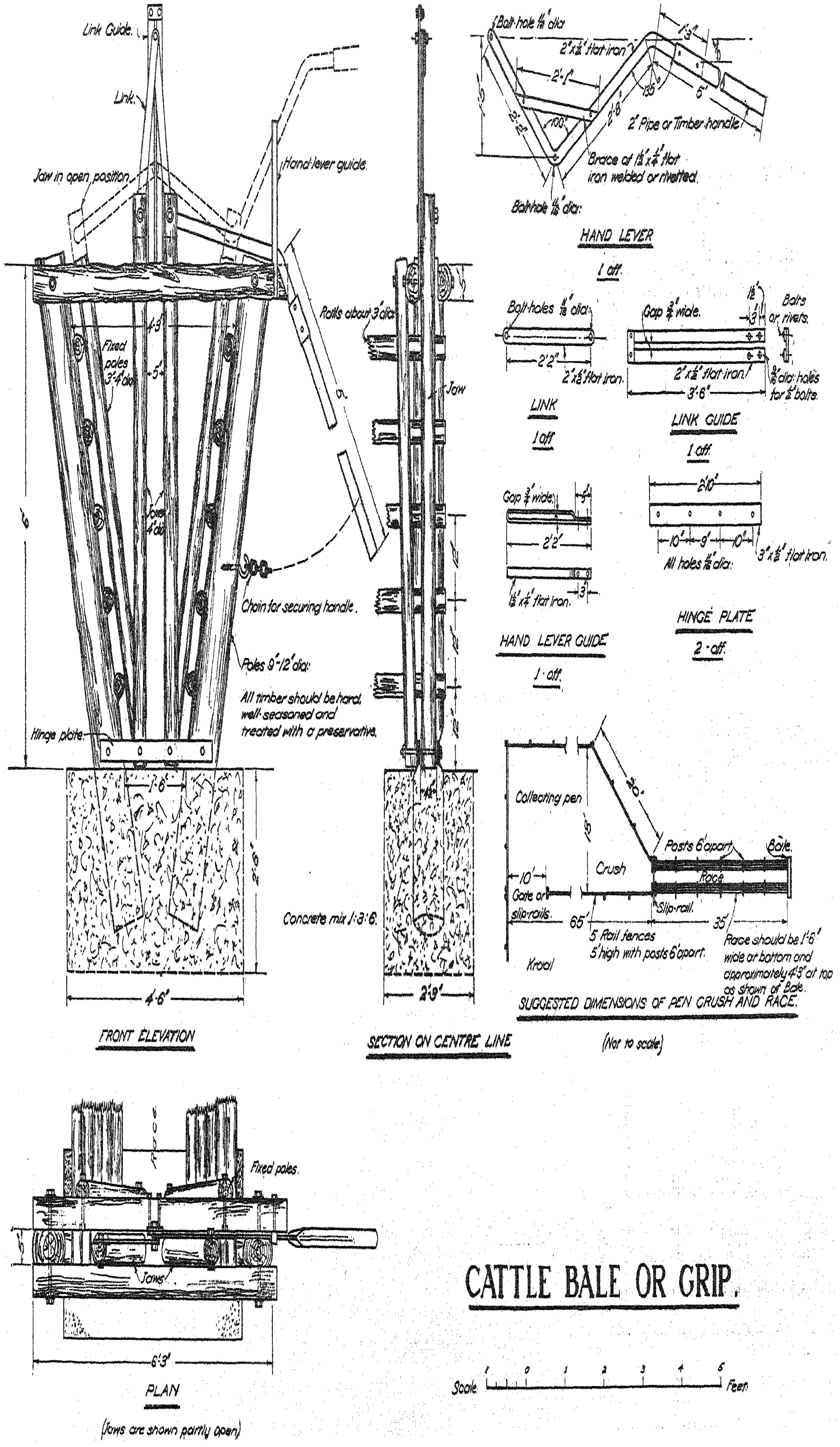
It is a dwarf, acaulescent shrub, but the short branches which appear above ground bearing leaves, flowers and fruit (fig. 1) spring from large and extensive underground stems, which ramify below the surface of the ground branching from stout "taproot" like stems. The size and extent of this system of underground stems is astonishingly great. The horizontal underground branches which ramify just under the surface of the soil sending up leaf bearing shoots every here and there, may in large plants cover many square yards, while the descending "taproot" like stems can be traced for surprising distances and to great depths. Near Pretoria in 1935 the writer was shown a plant which had been traced for a length of 95 feet to a depth of 40 feet below the soil level.

When the average day temperatures begin to climb steeply towards the end of August, the umKouzaane sends up its fresh green shoots and leaves. As this happens well within the dry season when the rest of the veld is brown or bare, these first green leaves are very conspicuous and attract grazing animals. Deaths from umKouzaane poisoning begin and continue until the dry season is terminated by the summer rains, which usually begin late in November or in December. The plants begin to flower very soon after the first shoots appear.

The flowers are small, greenish yellow and are produced in clusters on small stalks which arise from the axils of the leaves.

The fruit is a leathery drupe, oval or almost round and about 1¼ inches in length. It contains one large seed. Ripe fruit can usually be found in November, but is apparently not produced in equal abundance every year. In a patch of umKouzaane on the farm "Red Leaf" in the Nyamandhlovu district, a very heavy crop of fruit was observed in November, 1945. In the following year practically no fruit was borne by plants growing in this patch.

Identification of umKouzaane. umKouzaane can be easily confused with several other plants to which it bears a strong superficial resemblance. *Pachystigma pygmaeum*, *Pygmaeotham-*



CATTLE BALE OR GRIP.

nus Zeyheri and *Parinarium capense*, are plants of similar habit which produce leaves resembling those of umKouzaane about the same time. As these plants, which are grouped under the Sindebele name umKukuzela, are innocuous it is important to be able to distinguish between them and the virulent umKouzaane.

The following criteria will serve to identify umKouzaane and to distinguish between umKouzaane and umKukuzela.

1. *The leaves are alternate.* The leaves of umKouzaane are not opposite and do not arise by twos or three at the same level on the stem.

2. The young leaves are bright green on both sides. They are slightly hairy, but the hairs are very small, white and inconspicuous. The old leaves may be a yellowish green but they are quite smooth and free of hairs.

3. The leaf veins are looped at the outer edge of the leaf where they form arches. See fig. 2.

If the leaves of a suspected plant show all of the above characteristics, it is almost certainly umKouzaane, but to make quite certain, wrap a generous specimen in paper and send it by post to the Pasture Research Officer, P.B. 19K, Bulawayo, or to the Senior Plant Pathologist, Department of Agriculture and Lands, Salisbury.

Distribution. umKouzaane is widely distributed in the Northern Transvaal and has been recorded from Bechuanaland and South West Africa. In Southern Rhodesia it is widespread on sandy soils north-west of Bulawayo.

Its distribution appears to coincide roughly with the "gusi" fine sands of the Kalahari Geological System and it is probable that it occurs in the following native districts: Nyamandhlovu, in the northern end of Bulalima-Mangwe, Bubi and Sebungwe. In the Nyamandhlovu district on the farm "Red Leaf," about 25 miles from Bulawayo, it occurs in the Khami Valley and is here associated with the thorn trees *Acacia giraffe*, *A. erubescens*, etc. In the same district at Mpindo, in the Gwaai Reserve, it is very common in the teak forest. It is included in many different plant communities, but appears to be confined to light sandy soils. Detailed information about the exact distribution of this plant is required and it would be greatly appreciated if farmers who know of the existence of the plant on their farms would report its presence to the Pasture Research Officer, P.B. 19K, Bulawayo, who would be grateful for the following information:—

1. Farm Name.
2. District.
3. Vegetation and soil type in which umKouzaane occurs.
4. Approximate acreage infested.

The Toxicity of umKouzaane and its Palatibility. Cases of umKouzaane poisoning begin with the appearance of the first green shoots in August and continue until the onset of the rains in November or December.

Fig. 1.—*Dichapetalum cymosum,* showing the alternate arrangement of leaves and mature fruits.

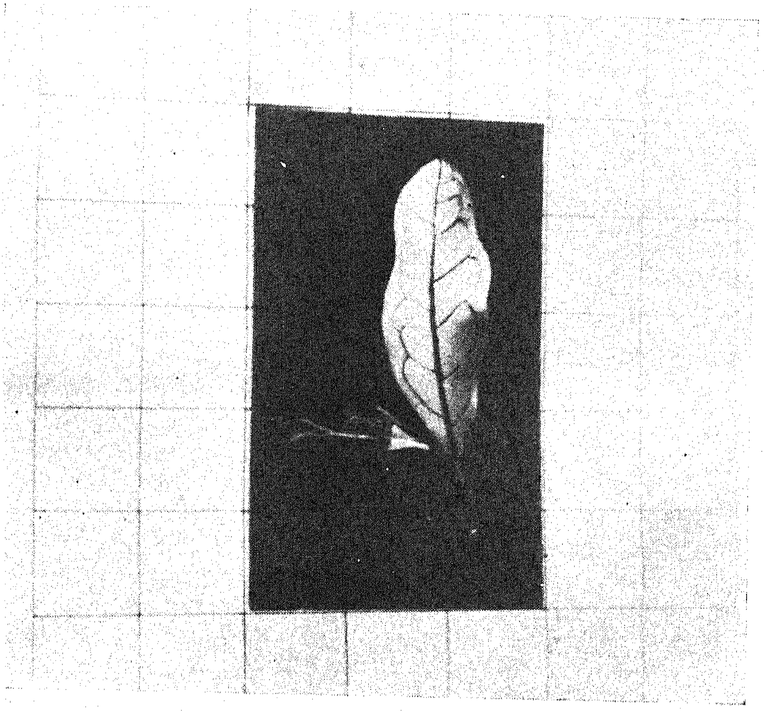


Fig. 2.—*Dichapetalum cymosum,* showing the peculiar leaf venation.

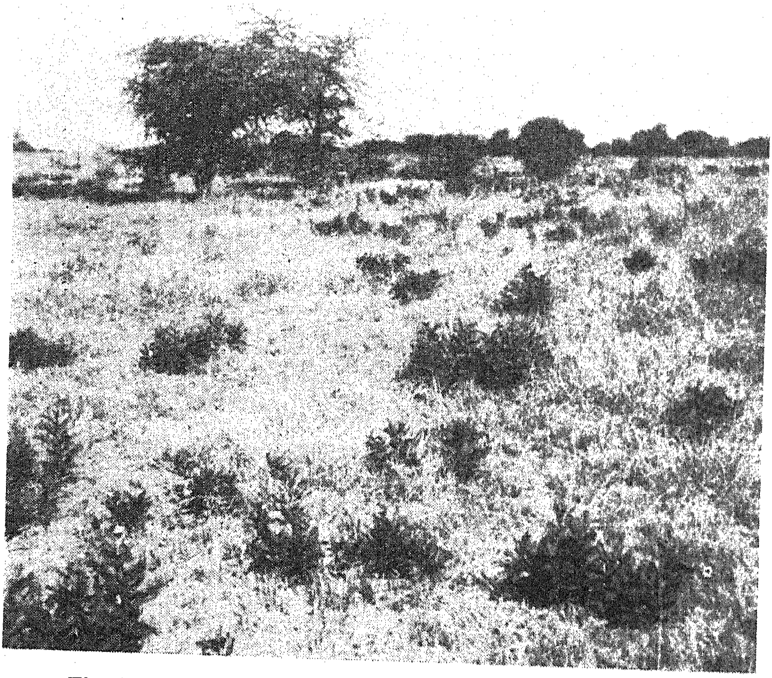


Fig. 3.—*Dichapetalum cymosum* on a farm in the Nyamandhlovu District.

Fig. 4.—*Dichapetalum cymosum* in a cultivated field (native), Nyamandhlovu District.

The widely held belief that one or two leaves is sufficient to cause death of an animal is not borne out by the results of experiments. Steyn([1]) states that "according to experiments conducted by Curson, Neser and Theiler, and subsequently confirmed by the author (Steyn) 20 gm. of the fresh young leaves *may be sufficient* to cause death in sheep and 90 gm. may be fatal to cattle." Also there is an enormous variation in the toxicity of different "varieties" of the plant growing on the same spot. In addition soil and climatic conditions may be responsible for a difference of toxicity in different localities.

At Nyamandhlovu, Shaw succeeded in killing a sheep and a goat by drenching with 2 ozs. of the leaf ground up in water, 6 ozs. of the ground up leaf induced severe symptoms of poisoning in a heifer weighing 350 lbs., but this heifer recovered. Two cows weighing about 800 lbs. each were killed by drenching with 16 ozs. of the leaves.

Shaw (2) notes that two dogs died after consuming a portion of the intestines of these poisoned animals, but that natives consumed the flesh with impunity, though they were careful to avoid the offal and the internal organs.

Green showed that all portions of the plant, including the fruit, contain the poison, and that young leaves contained most, while old leaves contained very much less. Practically nothing is known about the poisonous principle, except that apparently it is not prussic acid. (Steyn, 1.)

The fact that cases of poisoning usually terminate with the onset of the rainy season is due to two reasons. Firstly, the abundance of green growth renders the tufts of umKouzaane less conspicuous and less attractive, and secondly, old umKouzaane leaves are not nearly as toxic as the first fresh growth. This fact was established by the investigations carried out by Curson, Neser and Theiler. (Steyn, 1.) Even the fresh leaves of umKouzaane do not appear to be very palatable. Great difficulty was experienced in getting animals to take umKouzaane leaves in the feeding experiments carried out by the Veterinary Department on Mr. W. E. Wood's farm at Nyamandhlovu. Even when leaves were mixed with other food, animals endeavoured to push them to one side and to leave them altogether. (Shaw, 2.) This may, of course, have been the result of experience. The animals used in the experiments had been raised in an area where umKouzaane was a common plant. It is likely that animals unfamiliar with umKouzaane would consume it much more readily.

That cattle do become used to umKouzaane and are then not poisoned by it, because they refuse to graze it, is clearly demonstrated by Fig. III, which illustrates the abundance of umKouzaane around cattle kraals in the Gwaai Reserve near Mpindo Siding. A thick growth of umKouzaane surrounds the kraals and it is traversed every day by the native cattle on their way to and from grazing and water. Among these cattle, cases of umKouzaane poisoning are rare.

Prophylaxis. According to Shaw, the sulphur-salt lick appears to have a prophylactic effect against this type of poisoning.

Prevention. The surest method of preventing cases of umKouzaane poisoning is to fence off the areas in which the plant occurs and to protect these areas from grazing during the dangerous period.

Eradication of the Plant. The eradication of umKouzaane is a very difficult and laborious operation. Because of its well developed and extensive systems of underground stems, attempts to get rid of the plant by digging it out are very seldom successful and often serve to aggravate the nuisance. There is evidence to show that the repeated ploughing of a patch of umKouzaane which was located in the middle of a cultivated field, eventually eliminated it, and though I have no doubt that it would be possible to get rid of a patch of umKouzaane by just digging it out in a very thorough manner and then by repeatedly excavating every shoot as it appeared over a period of years, quicker and more economical results can be obtained by poisoning, though the methods which can be employed successfully are laborious.

Working in the Transvaal, Leemann (3) devised a technique which gives good results.

The patches are carefully excavated until the main stem or stems are discovered. The earth is removed from around each main stem to a depth of about 9 inches. The main stem is then ring-barked, and in this operation the bark is cut away in a downward direction to leave a frill around the bottom end of the barked area. A few stones are then packed around the barked stem to form a receptacle for the poison which is packed in between the stones and the stem. The poison is a mixture of two parts of calcium chloride, one part copper sulphate and two parts of soil. In this mixture the copper sulphate is the poison, while the function of the calcium chloride (which is strongly hygroscopic) is to draw moisture from the surrounding soil in order to keep the poisonous pack moist.

When the pack is applied it should be of the consistency of stiff mud. It should be applied generously so that the whole of the ring-barked stem is surrounded by a pack several inches thick. Leeman was successful, too, with a pack composed of sodium arsenite one part and soil four parts.

The method is most successful when the soil is damp, i.e., after the rains have started. It is necessary to follow up the first application of poison and to re-poison plants which are not completely killed when they begin to grow again.

umKouzaane can be killed by repeated defoliation. Reports (4) indicate that successful results have been obtained by using a mixture of one part of Kerol and three parts of illuminating paraffin.

Using an ordinary atomiser of the flit-pump type, the leaves are sprayed as soon as they appear in August and the spraying is repeated with each appearance of new leaves. It is said that three to five sprayings during the first season, three to four during the second, and about two during the third season suffice to kill a proportion of the plants, while the remainder are so weakened that a further two sprayings during the fourth season are usually sufficient to produce a total kill.

Biological Control. The plant is parasitised by the larvae of a moth, *Sindris albimaculatis*, Rag., which burrows into the fruits and destroys the seed. It is probable that the presence of this parasite exercises an important control on the amount of viable seed produced by umKouzaane.

Summary. *Dichapetalum cymosum* is a poisonous plant which annually causes a large number of deaths among domestic animals.

The appearance and habit of this plant, its identification, distribution, toxicity and palatability are described and discussed. Methods of preventing cases of stock poisoning and eradicating the plant are outlined.

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2. Shaw, G. D. "Sulphur-Salt Lick for 'mKouzaane." Vuka, IV, 4. December, 1946, pp. 54-57.
3. Leemann, A. C. "The Eradication of Gifblaar." Bulletin 153, Union of S.A. Dept. of Agriculture, 1935.
4. du Toit, E. Personal Communication.

Feeding and Drinking Appliances for Poultry

By G. H. COOPER, Assistant Poultry Officer.

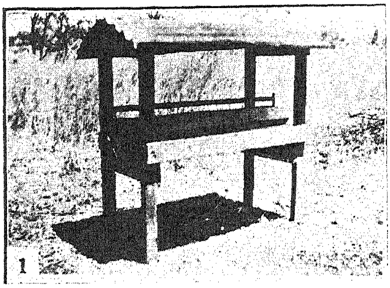
In very few poultry keepers' yards is there to be found a good selection of appliances and it is the hope that some improvement may be made in this respect that these few notes on the construction of some simple appliances are given. Frequently wastage of feed from unsatisfactory feeders amounts to more than actual consumption.

Material. Timber of any sort has been found to be most unsuitable for poultry appliances in this country, because of the havoc caused by white ants and the fact that in the dry atmosphere all wood shrinks and nails drop out in time.

Galvanised iron should be used wherever possible, for it is not subject to these disadvantages and it is cheaper eventually; further, it is hygienic and is more or less everlasting. It makes a neater job. Concrete or cement is also an excellent material with which to make water vessels and feed troughs. The following appliances were made and tested out at the Matopo School of Agriculture and the Government Poultry Station and have given every satisfaction.

Feeder for Mature Birds (Figs. 1 and 3). Many poultry keepers are changing their ideas about the usefulness of a large hopper-feeder, because these so-called self-feeding hoppers rarely do self-feed in practice, and further, it is preferable to place before the birds daily a fresh lot of mash. In self-feeding hoppers the birds tend to pick out certain feeds from the mash and leave the rest, which may remain before them some considerable time. The amount consumed can be better regulated in a feeder without a hopper and rats and wastage are less troublesome. The feeder described here is for half grown pullets or mature birds on range and will serve for 30 birds. If it is to be used in a laying house the top protection of iron is not necessary, the legs ending level with the alighting board. These feeders are portable and non-wasting if not over-filled. If cocks with large combs have to use this type of feeder it will be necessary to raise the roller above the trough an inch more in order not to damage the comb.

Construction. Four troughs without ends can be made from a sheet of flat galvanised iron 6 ft. x 3 ft. A strip of iron 18 inches x 3 feet is cut from a sheet of iron, being careful to cut at right angles. Each edge along the three foot sides is bent over $\frac{1}{4}$ inch or less to make a round edge. Three inches from each edge so rounded the iron is bent at right angles lengthways. Again six inches from each of the right angled bends the iron



(1)

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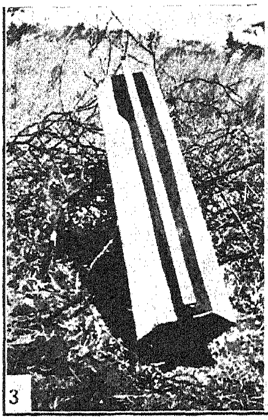

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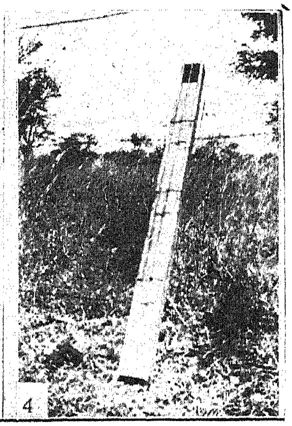

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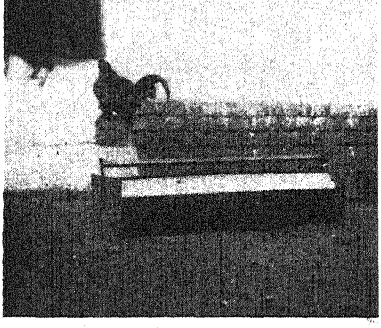

(7)

(1) Outdoor Feeder for Mature Birds.
(2) and (6) Water Fountains for Small Chickens and Mature Birds.
(3) The Metal Trough. Section of Feeder.
(4) and (5) Metal Feed Troughs for Chickens at different ages.
(7) Feeder on Ground Level for Half-grown and Mature Birds.

is again bent at right angles lengthwise. This gives a V-shaped trough 3 feet long 6 inches deep with 3 inch lips bent inwards.

The ends are cut corresponding to the shape of the end of the trough, bent and rivetted on. Wooden ends may be used but are not recommended.

Before fastening in the ends pieces of firm hoop iron 3 inches long, one with an $\frac{1}{8}$ inch hole near the top and one with a slot leading to an $\frac{1}{8}$ inch hole, are rivetted one to each end in the middle and allowed to project over the top end, so that the holes are $1\frac{1}{2}$ inches from the top of the end.

A piece of wood 1 inch x 1 inch x 3 feet is taken, a $2\frac{1}{2}$ inch nail cut in half and each half hammered into an end of the wood in the centre, leaving $\frac{1}{2}$ inch projecting. This forms the roller and is placed in position by pushing the nail without head through the hole in the hoop iron at one end of the trough and the other into the hole at the other end by means of the slot. This roller will now revolve on being touched and so serve the purpose of keeping the birds from getting into the feeder or from perching on the roller and soiling the feed. A piece of plain wire No. 8 fastened along the top in the position of the roller has also been found satisfactory. This completes the trough section (fig. 3) which is placed in a stand as shown in the photograph (fig. 1).

The stand can be conveniently made from timber to be had from a motor car case or flooring board.

Take four pieces of timber each 2 inch x 2 inch x 2 feet 9 inch to form the legs, or preferably four pieces of angle iron 2 feet 9 inch long; these are held apart lengthwise by cross pieces 3 feet x 3 inch x $\frac{7}{8}$ inch nailed or bolted at right angles, the top of cross pieces being 18 inches from ground level.

Two pieces of timber 16 inch x 6 inch x $\frac{7}{8}$ inch are nailed or bolted to the inside of the leg pieces at the same height as the cross pieces. These serve to keep the legs apart across the structure and to hold the trough. Before fixing these last planks in position a right angle notch is sawn out of the middle of each, the point of the V being half way, or 3 inches down, the plank.

Two pieces of timber, 3 feet x 3 inches x $\frac{7}{8}$ inch are next nailed to the last mentioned pieces, one on each side, between the legs to serve as alighting boards for the birds to stand upon when feeding. Again two pieces 16 inches x 6 inch x $\frac{7}{8}$ inch are taken and sawn to form a sloping top, being 3 inches at the ends and 6 inches in the centre. One piece is nailed to the projecting legs above the trough at each end. Over these is bent and attached with screws a piece of corrugated or flat iron 3 feet x 2 feet. Feeders may be made 6 feet long by cutting the sheets

of iron in half lengthwise. If this is done a wooden support is advisable half way inside the trough and, of course, the stand must be made the appropriate length. The feeder is now complete and may be used for mash dry or wet, and grain feeding. At least 2 inch feeding space per bird is required, and 2 linear feet of oyster shell feeder space per 100 birds.

For birds on range during the dry months, a similar trough feeder with square ends to stand on the ground may be used. (Fig. 7.) It is cheaper as no stand is required, but is not suitable for laying houses where litter is used.

Feed Troughs for Chickens (Fig. 4). For baby chickens until about three weeks of age. A piece of flat galvanised iron is cut 3 feet x 7 inches wide. Each 3 feet edge is bent over ¼ inch to form a smooth edge. Again each 3 feet edge is bent at right angles ¼ inch from the edge. One and one-half inches from each of these right angle bends the iron is again bent at right angles. This gives a 3 feet rectangular trough 3 inches wide, 1½ inches deep, with a ¼ inch lip turned inwards along each side.

Two ends of galvanised iron about 3½ inch x 2 inch are cut, bent to fit and rivetted into each end. A piece of plain galvanised wire No. 10 is taken 3 feet 1 inch in length and ½ inch turned at right angles at each end. This wire is placed down the centre of the trough and the bent over ends soldered to the ends of the trough. Seventeen pieces of similar wire 5 inches in length are taken and in the centre are looped around the wire running lengthwise down the trough. The seventeen short wires are now soldered on each side of the trough at regular intervals of 2 inches. These are at right angles to the long wire and keep it firmly in place along the centre of the trough. The wires prevent chickens from getting into the trough and scratching out the mash. For chickens from three weeks to three months of age similar troughs can be made of slightly larger dimensions having an opening each side of the centre wire of not more than 2 inches and 4 inches deep. (Fig. 5). Concrete feed troughs are used as fixtures in poultry houses. They are best built on the partition wall between houses. A simple trough shape about six inches deep is suitable. A hinged metal cover with slots to enable the birds to feed, or plain wire grill with 2 inch spacing is necessary, to prevent the birds getting into the trough. A lip of cement or iron 1 inch wide along the front at the top edge of the trough is essential to prevent wastage. An alighting board is, of course, necessary and should be on a level with the bottom of the trough 2 feet 4 inches from the floor level. Feeders for other than permanent houses are best constructed from flat iron as described and many prefer these in laying houses also.

The small chick feeder (fig. 4), a medium size of the same type (fig. 5) and the larger trough type with square ends for use on the ground as described, cover all the requirements of growing chickens. For adults this last mentioned trough (fig. 7) is used for range birds also, otherwise the type as described (figs. 1 and 3) with stand will meet all their needs.

Green Food. The best and most hygienic method of feeding succulent greens is to chop it in a cutter and feed it in cone-shaped 1 inch mesh wire netting baskets suspended in the house about 9 inches from the floor or litter for adults. For chickens they should be nearer the floor. Some soft greens like lettuce may be hung up without cutting, but where long pieces of tougher greens may cause crop trouble, they should be chopped. About 4 linear feet of greens feeder space is required per 100 birds. These comprise all the feeding utensils that will be required on the poultry farm.

Drinking Vessels (Figs. 2 and 6). For baby chickens until about 2 weeks of age where only a few are being brooded a small tin such as a 2 lb. jam tin with one open end and a nail hole punched about ½ inch from the open end, makes a good fountain when filled and reversed in a saucer or metal pan. For larger numbers tins holding more water such as 1 gallon tins may be used in the same way. The drinking pan should be made of galvanised iron 1 inch deep and 1 inch larger all round than the tin or receptacle to be used as the reservoir. The hole punched in the tin should be ¾ inch from the open end to allow the water to flow out to this depth in the drinking pan when the reservoir is reversed on the pan after filling. The hole must be below the lip of the pan otherwise the water will flow continuously.

The same type may be made for larger chickens and adults, using 4 gallon petrol tins as receptacles and making the pan to suit. For adults the pan should be 3 inches deep and 2 inches larger all round than the receptacle.

In intensive houses water troughs may be built of concrete on to the front wall 2 feet from floor level with an alighting board and metal cover opened from the outside for filling and cleaning. Alternatively, open iron vessels of any convenient size and shape, but not deeper than 6 inches, may be made and placed on a stand in the house or fitted on to the end of the nest battery. Birds should not be able to perch above them or contaminate the water with droppings or litter.

Cement or Concrete Vessels. A mould is necessary to make water vessels, and these should be made circular to avoid corners which are difficult to clean, or, if this shape is not suitable, the corners in a rectangular vessel should be well rounded on the inside. Any size that is convenient may be made, but usually they should not be deeper than 9 inches.

A cover to prevent the water being contaminated by droppings and dirt or from becoming heated by the sun if exposed, is necessary, and should be made of iron in such a way that the birds have easy access to the vessel.

In semi-intensive runs these concrete vessels may be conveniently placed along the fence in the lanes between houses so that they can be filled without going into the run. The metal cover can be hinged to lift for filling and removal. Water vessels should, however, also be placed inside the houses.

These appliances are easily constructed and if the poultry farmer will study the requirements of his flock he will probably be able to improve on them himself.

Alternative Green Manure Crops

By S. D. TIMSON, Agriculturist.

[Bulletin No. 1277 Revised.]

Owing to the shortage of sunn hemp seed, and also to the damage done to this crop by various insect pests, many farmers are seeking alternative green manures and the following notes are written with the object of assisting them to decide on a substitute.

Taking all the practical considerations into account, sunn hemp clearly proved its superiority over all other crops as a green manure until the various insect pests attacking it appeared. Now that this crop must be planted late in the season to avoid damage by those pests, there are other crops and mixtures of crops which can be expected to give a better restorative effect on our maize soils.

Recent experiments carried out by the Department of Agriculture indicate that by planting the sunn hemp crop late (after Christmas) the farmer is incurring a loss in yield of the two following maize crops combined of something like 14.0 per cent. as compared with the sunn hemp crop which is sown early, as was formerly the rule. This is clearly a serious matter to the maize grower and, taken alone, is sufficient cause for him to seek an alternative green manure, without considering the added difficulty of obtaining sunn hemp seed, and its high price.

The following crops or mixtures can be recommended as likely to give results equal or superior to a *late-sown* crop of sunn hemp in so far as the increase in the yield of the two following maize crops is concerned.

WEED-SMOTHERING CROPS.

Sunflowers and Upright Cowpeas. About 30 to 35 lbs. of sunflowers and 20 to 25 lbs. per acre of the Saunders Upright Cowpeas may be sown broadcast. The seeds can be mixed and sown together, but the mixtures should be kept well stirred to ensure a fairly even stand of the two crops.

Although the sunflowers soon overtop the cowpeas the latter make good growth under them, and the mixture is a satisfactory weed smotherer, particularly if sowing is immediately preceded by a stroke of the harrow.

Sowing should be done in the latter half of December so as to avoid the ripening of the seed of the sunflower prior to ploughing under, which would entail killing the self-grown crop of sunflowers

before planting the following maize crop. When the first month of the succeeding season is very wet it may be very difficult to kill such a self-sown crop, and planting of the maize crop may be seriously delayed.

Owing to deep penetration of the soil by the root systems of these crops this mixture would be particularly suited for sowing on soils where a plough pan has been formed or is suspected.

The cost of the seed of this mixture is about 12/- per acre at present prices.

Sunflowers and Velvet Beans. This mixture is reported to be satisfactory by some farmers, who say that it is reasonably easy to plough down. The writer has no personal experience of it.

Suitable seeding rates would appear to be 40 to 50 lbs. of beans and 35 lbs. of small-seeded black sunflowers. The Somerset variety of beans should prove most suitable in this mixture, since it is the most rapid in growth.

Sunflowers. When sown broadcast at the rate of 50 to 55 lbs. of seed per acre this crop is a better weed smotherer than sunn hemp, but its manurial value may be expected to be rather less than the sunflower-cowpeas mixture, but rather better than a *late-sown* crop of sunn hemp.

It suffers from the same disadvantages as mentioned in the third paragraph of the notes on the sunflower-cowpeas mixture.

The cost of the seed is about 8/6 per acre at ruling prices.

Sunn Hemp and Munga (N'Youti). Where a farmer is short of his requirements of sunn hemp seed he can eke it out very well by mixing munga seed with it. Suitable seeding rates are 20 to 30 lbs. of sunn hemp and 10 to 20 lbs. of munga.

The two crops grow well together, but the munga seed must not be covered as deeply as sunn hemp normally is. If the two are sown together they are probably best covered by a spike harrow. The munga should only be covered about ½ inch to at most 1 inch deep.

On land infested with witchweed this mixture has a special value and can be highly recommended as a green manure on infested soils, in preference to sunn hemp, since the munga will destroy a proportion of the witchweed, for it germinates the seed of the parasite, but the latter later dies before it can ripen seed, and generally before it reaches the surface of the soil.

The price of munga is about 23/- per bag, and so a considerable economy in the cost of seeding as compared with sunn hemp alone is made by employing the mixture.

The manurial value of the mixture will be approximately the same as that of sunn hemp alone. It was used over five years on the Witchweed Demonstration Farm, and proved very satisfactory.

In buying seed of munga for sowing on witchweed infested soil it should be inspected to see that it is free from admixture with kaffir corn or rapoko seed, since these latter crops are hosts of the

Munga (N'Youti) and Cowpeas. Another satisfactory green manure mixture is that of 20 lbs. of munga and 20 lbs. Saunders Upright cowpeas, or 25 lbs. of Turiani Upright cowpeas per acre. The latter variety of cowpeas tends to thrive better than the former on the heavy soils of the maize belt. It also takes about two to three weeks longer to mature than the Saunders variety, which allows the mixture to be planted about the third week of December on the high veld (Salisbury) with little likelihood of trouble being caused in the following season by a self-sown crop of cowpeas.

The cowpeas must first be broadcast and covered by disc-harrow. The munga is then immediately broadcasted and covered by a *light* spike-harrow.

This mixture can be expected to give appreciably better yields of a following maize crop than a January planted sunn hemp crop.

Its ability to smother weeds depends on obtaining a good stand of the munga, and for this reason the munga seed must be covered lightly—no more than a half to one inch deep.

The cost of seeding is about 10/6 per acre.

Other Possible Mixtures with Munga. Other potentially satisfactory mixtures with munga that have not yet been tried as far as is known, are those with velvet beans, or dhal or dolichos beans.

Since all these crops require a long season to mature seed they may be broadcasted and disced in on dry land before the rains, and although they are slow in growth and cannot compete with weeds, the admixture of munga will serve to control the latter except on land that is very dirty.

Thirty-five to fifty pounds of Marbilee, Jubilack or No. 74 velvet beans, 30 to 40 lbs. of dhal, or 20 to 25 lbs. of dolichos beans per acre would be suitable rates of seeding to combine with 20 to 25 lbs. of munga.

The munga would be sown and covered with a light spike harrow immediately after the other crops have been planted.

Dhal has a very deep and strong tap root, and should be particularly useful on land where a plough pan has formed, or where the soil has been poached or puddled.

Munga (N'Youti) or Pearl Millet. Munga itself is a good green manure crop, but since it is a non-legume there is some danger of temporary nitrogen starvation of a following non-legume crop such as maize if the munga is ploughed down when mature after the cessation of the rains. It is for this reason that one of the munga-legume mixtures given above is to be preferred as a rule. It has big advantages, however, over other crops in the cost of seeding, since this is less than 3/- per acre at a rate of 25 lbs. per acre, and compared with the munga mixtures it only requires one seeding and one covering operation.

The seed bed should be rather finer than for sunn hemp, since the seed is small, and for the same reason *the seed must be covered lightly with a light spike harrow. Light covering of the seed is essential, particularly on the heavy soils.*

Munga has a special value on witchweed infested land as mentioned under "Sunn Hemp and Munga," but care must be taken that the seed is not mixed with kaffir corn and rapoko (finger millet) seed, since these are true hosts of the parasite.

Munga is preferably sown in moist soil after soaking rains in December. When sown thickly (25 to 30 lbs. per acre) it competes well with weeds, but on really dirty land one or two crops of weeds should be killed prior to sowing it, or, alternatively, sunflowers or a sunflower legume mixture should be used.

Being a non-legume it does not decay so rapidly as legumes or mixtures containing a legume and should therefore be ploughed down at the end of March in order to ensure that too much unrotted trash is not present at the next planting season, and also to safeguard against temporary nitrogen starvation of a following non-legume crop.

In an experiment at the Agricultural Research Institute, Pretoria, covering 10 years, a munga green manure crop gave slightly greater yields of maize than sunn hemp ploughed under.

Other Mixtures with Sunn Hemp. Sunflowers can also be used in a mixture with sunn hemp for the sake of economising seed of the latter. Suitable seeding rates are 30 to 35 lbs. of sunflowers with 20 to 25 lbs. of sunn hemp, but this reduces the manurial value by something like five per cent.

The Saunders Upright cowpeas also combine quite well in a mixture with sunn hemp, and suitable mixtures would be 20 to 25 lbs. of sunn hemp with 20 to 25 lbs. of cowpeas. This mixture can be expected to be the equal of sunnhemp alone from the manurial standpoint on heavy soils, and possibly superior on sandy soils or on soils where a plough pan has formed.

These two mixtures plough under readily.

GREEN MANURES WHICH REQUIRE CULTIVATION.

Velvet Beans. This crop can be considered as being fully the equal of an *early-sown* sunn hemp crop from the manurial standpoint, and as being somewhere in the neighbourhood of 15 to 17 per cent. superior to the *late-sown* sunn hemp crop (sow in early January) as judged by the yields of two maize crops following it. These estimates and others given above are based on results of experiments at the Salisbury Experiment Station.

However, it suffers from several disadvantages compared to sunn hemp. It requires two cultivations at least to kill weeds; it is more difficult to plough under; and it cannot be planted dry *by machine* before the seasonal rains commence, unless the land is brought to a fair tilth in autumn.

On the other hand, the cost of seeding per acre (about 4/6) is very much lower than that of sunn hemp (about 14/-). The difficulty of ploughing in the crop can be eased by planting sunflowers between the rows two or three weeks after germination of the beans; but this, of course, lowers the manurial value of the crop somewhat. The broadcasting of munga at the rate of 10 lbs. per acre might be tried as a substitute for the sunflowers. If this proves suitable it

would have the added advantage of killing a proportion of any witchweed present in the soil as mentioned above.

The normal spacing for velvet beans is 36, by 15 to 18 inches, but if this is closed to 28 to 30 inches by 12 to 15 inches the crop will sooner get above the weeds and thus perhaps save a cultivation. The varieties which take longer to mature, such as the Marbilee and Jubilack, are the more suitable for green manuring.

Cowpeas. This crop is more suited as a green manure to the drier areas of the Colony since it may not thrive under heavy rainfall, and furthermore it is subject to attack by the stem maggot on some farms in Mashonaland. It thrives better on sandy soils than on the heavy loams.

It can be planted in rows like velvet beans, but it should not be planted early, but rather towards the end of December in Mashonaland so as to escape some of the rainfall and also the possible attacks of stem maggot, and to avoid trouble from a self-sown crop.

The advent of the "Saunders Upright" variety with its very upright habit of growth and heavy yield of small seed has made the use of this crop as a green manure more attractive. On clean land, or after killing one or two crops of weeds, the broadcasting of the crop at the rate of 40 to 50 lbs. of seed per acre is possible, but experience is somewhat lacking at present. The broadcast crop cannot be expected to smother weeds, but must be assisted in this matter by killing one or two crops of weeds before sowing.

Owing to its deeply penetrating taproots the crop may prove to have a special value in breaking up a plough pan, but direct evidence of this is lacking at present.

The cost of seeding an acre with 40 lbs. of seed broadcasted is at present about 10/-. When drilled in rows 30 inches apart, and 3 to 4 inches apart in the rows, a seeding rate of about 8 to 10 lbs. only per acre will be required, and the cost would therefore be about 2/- to 2/6.

GREEN MANURES FOR THE EASTERN BORDER HIGHLANDS.

Lupins. On the highlands of the Eastern Border that have a heavy rainfall, none of the legumes mentioned can be depended upon to make satisfactory growth as green manures. Sunn hemp will not thrive at elevations much above 5,000 feet above the sea. Cowpeas and velvet beans dislike the heavy rainfall of this area, and the high acidity of most of the soils.

Fortunately the lupins thrive on this high country, and particularly on the sandy soils. Moreover, they have a preference for acid soils, and will not thrive on those that are alkaline.

Where they have been grown in the Inyanga district the soils contain the necessary lupin bacteria, but in certain cases in the writer's observation these bacteria are not present in all the soils of the Melsetter district, although in certain cases on adjacent farms they have become well inoculated.

Where the soil does not contain the specific lupin bacteria either the seed should be inoculated, or a bagful of soil from a field which has grown a well inoculated crop may be broadcasted over each acre of the land to be planted. This work should be done in the evening and the land harrowed immediately the inoculated soil is broadcasted, since the bacteria are killed by sunlight. In taking the soil from an inoculated field the top two inches should be discarded, and the next two or three inches of soil should be used.

Both the Blue and Yellow lupins make satisfactory growth, and may be drilled in rows 30 inches apart, and 6 to 9 inches apart in the rows. They require a long season and should be planted in November or early December on dry land. On irrigated land they can be planted at any time when the soil is warm enough to allow the seed to germinate. At the above spacing about 15 to 20 lbs. of seed will sow one acre. When seed is plentiful, they can be broadcasted at the rate of 80 to 100 lbs. per acre.

Soya Beans. Soya beans will thrive under a much heavier rainfall than will velvet beans or cowpeas, and for that reason can be recommended for green manuring on the Eastern highlands in preference to those crops. A robust type is required for the purpose, and the Jubiltan hay varieties are recommended, and also the Hernon varieties Nos. 55 and 18, which are suitable for hay as well as grain production.

They should be drilled at a spacing of 28 inches by 3 to 4 inches, at which spacing a seeding rate of 20 to 30 lbs. per acre is required according to size of seed of the variety.

The seed or the soil must be inoculated, since our soils in general do not contain the specific soya bacteria. Sufficient soil to inoculate 400 lbs. of seed is available free of charge on application to the Manager, Agricultural Experiment Station, Salisbury. The soil itself may be inoculated as described for lupins.

The expenditure on killing seeds can be reduced by harrowing the growing crop with a light spike harrow until it is 6 to 8 inches high, but the work should not be started until the sun has been up 3 or 4 hours, when the soya plants will be less brittle. The land should also be free from loose trash which will clog the harrows.

Where the soil has a pH value of 5.5 or less it will be necessary to apply agricultural lime to the soil to ensure good growth of the crop. Dressings of a half to a ton per acre would be suitable.

Eelworms. It must be borne in mind that where crops which are susceptible to this serious pest are to be grown in the future those crops mentioned above which are not immune to it should

not be grown, since even a small infestation of the soil will be seriously increased.

Under such conditions only sunn hemp, munga and the Jubilack, Marbilee and Somerset varieties of velvet beans can be recommended.

Dolichos beans, sunflowers, and cowpeas (all locally grown varieties) are very susceptible to attack.

It may be mentioned that among the more important field crops which are susceptible to eelworm attack are potatoes, tobacco, onions, sweet potatoes, soya beans, haricot beans, cotton, pyrethrum.

If in doubt regarding the susceptibility or resistance of any crop to this pest the Department of Agriculture should be consulted.

Balanced Manuring

By W. G. OGG, M.A., Ph.D., Director, Rothamsted Experimental Station, and the Imperial Bureau of Soil Science; and HUGH NICHOL, Ph.D., F.R.I.C., Imperial Bureau of Soil Science.

[Extract from the "Scottish Journal of Agriculture, January, 1945.]

The Opposition to the Use of Fertilisers. In recent years violent attacks have been made on the practice of using so-called artificial fertilisers. It has been claimed that the only manures that can properly be applied are "natural" ones—meaning thereby the products resulting from the decomposition of plants, with or without the intervention of animals.

The term "artificials" is unfortunate and misleading, and it would be desirable to discontinue its use. A hundred years ago, guano and Chile nitrate were novelties and were called "artificials" to distinguish them from the manures produced on the farm; yet both are as natural as the shell sand which farmers near the coast spread in their land or as the kelp used by others. The name was also applied to other substances like sulphate of ammonia, superphosphate and basic slag which were produced in factories. Later, nitrate of soda was processed to purify it and so were potash salts, also derived from natural deposits. Then we have ground mineral phosphate, which is more "natural" than, say, burnt lime.

Most of the so-called artificials in common use to-day are inorganic, but that may not necessarily hold good in the future. A good rough-and-ready distinction is to apply the term "manures" to bulk organic manures and "fertilisers" to the others.

Setting aside the question of the "naturalness" of Chilean nitrate, potash salts, and other mined or quarried products, we may ask why natural products should be supposed to be any better than materials which have been processed in a factory. If we discard artificial fertilisers, should we not discard artificial lighting, artificial shelter from the elements, and all the rest of the appurtenances of modern life? Agriculture is a very artificial business. Nature never intended that plants of one kind should grow in straight rows over acres of land, and she shows her dislike by ceaselessly trying to cover any bare ground with other plants more to her liking; but we do not, therefore, give up farming and content ourselves with what we can get out of the weeds and natural vegetation; and we breed and rear our animals almost as artificially as our crops. Even dung and compost heaps are by no means natural, and lime is an alien substance in many types of soil.

There are several schools of those who believe we should avoid the use of fertilisers. Some of these profess nothing more than that one should rely on the products of the farm. Apparently, for

these people, a chemical is a bogy connoting harm and ill-health. In the same way, some people dislike spiders, and no amount of allusion to Robert the Bruce will induce spider-haters to take kindly to spiders. It is a matter of like and dislike, not logic and reason, and one does not need to be a chemist to think that such antipathies are a poor basis for a policy of land fertility.

There are, however, gradations in the dislike for fertilisers; many will admit burnt lime as a natural manure (just as some tee-totallers accept port), and a section would permit the use of basic slag, though they recoil from the thought of superphosphate.

There are positive as well as negative aberrations. There are schools which practise bio-dynamic manuring under the banner of anthroposophic philosophy, not merely rejecting fertilisers, but practising rituals recalling the magical practices of the alchemists and the mental mannerisms of a Dark Age, in which ceremony stood substitute for knowledge.

Most of the opponents of fertilisers agree in alleging that fertilisers poison the soil, bring about erosion, injure the quality of crops and lower the ability of plants to resist disease. Further, they hold that animals and human beings consuming these crops are particularly susceptible to many diseases. Their beliefs are held with religious fervour and their attitude is non-scientific. Nevertheless, some of them endeavour to bring forward in support of their claims scientific work which appears to fit their own views, though they ignore evidence unfavourable to them. They have, however, brought forward no sound experimental evidence of their own in support of their claims. One of their chief arguments appears to be *post hoc ergo propter hoc*, but most of the ills of soils, plants and animals which they cite existed before fertilisers were discovered, and are rife where fertilisers have not been used. Malnutrition is no new trouble, and soil erosion was a problem to George Washington and his hardly less famous and equally enterprising successor, Thomas Jefferson. Another argument is of the Aunt Sally type. It consists of putting up what no scientist has said since the earlier years of Baron Liebig, and then refuting it vigorously. No reputable agricultural scientist of modern times has decried the value of organic manures or has claimed that fertilisers can fulfil all their functions.

There are still many gaps in our knowledge of soils and plant nutrition, but the problems are complex. At Rothamsted, some of the classical experiments have been carried on for periods ranging up to a century; although not designed on modern lines, they have provided, and continue to provide, much valuable information about the relative value of the nutrients in organic manures and inorganic fertilisers in increasing yields, and about their effects on the soil, on crops and on crop pests. Much criticism has been levelled at these classical Rothamsted experiments, but the critics have failed to understand their purpose or implications and have attributed to them meanings which were never intended. These experiments were not designed to solve all the complex problems of soil fertility to which attention is now being directed, and numerous additional experiments have been undertaken. A vast amount of work dealing with the effects of fertilisers with and

without organic manures has also been done at very many centres in this country and throughout the world. The conclusions are, therefore, not based on the investigations of any single institution.

THE ALLEGED HARMFUL EFFECTS OF FERTILISERS.

(a) **Effects on the Soil.** It is claimed that fertilisers are harmful to the chemical and physical condition of the soil, but where suitable and well-balanced fertilisers have been used, under proper conditions, there is no evidence that this is the case. At Rothamsted, where, for experimental reasons, soils have been treated quite abnormally by applying heavy annual dressings of fertilisers alone for a hundred years, high yields have been maintained and the soils are still for the most part in excellent condition.

It is, of course, recognised that the use of sulphate of ammonia increases the rate at which lime is removed, which, in time, leads to acidity. This is readily corrected by liming. The continued application of large dressings of sodium salts to some heavy soils may have an adverse effect on their physical condition, rendering them sticky, but for such soils there are other types of nitrogenous fertilisers which can be used.

It is often alleged that fertilisers cause soil erosion, which, though not a major problem in this country, is of very great importance in many parts of the world. It can be stated categorically that there is no evidence of any logical connection between erosion and the use of fertilisers. Erosion was prevalent long before fertilisers were discovered, and occurs where they are not used. It is true that erosion, and particularly water erosion, is very pronounced in some areas where there is a large consumption of fertilisers; for instance, in the cotton-growing States of America. The trouble, however, is due not to the fertilisers, but to the system of farming. If crops which are not soil-protective are grown repeatedly, the soil is mercilessly exposed to erosive action.

Fertilisers have been of great value in helping to establish soil-stabilising crops and leys. In recent years, the incorporation of organic matter into soil has been widely and wisely recommended by agriculturists as one useful means of arresting both wind and water erosion, but it would be a mistake to think that opposition to the use of fertilisers is implied. Some soils with a very high content of organic matter, e.g., the fen soils of East Anglia, are very subject to erosion, especially by wind, and what has to be aimed at to combat this is to produce conditions favouring the formation of soil crumbs instead of dust, and to promote the growth of roots, which bind the soil together. In so far as organic manures achieve these purposes, they are highly beneficial, but fertilisers also play a very important part by helping to produce bigger crops and hence more roots, stubble and straw to incorporate in the soil.

It is also claimed that fertilisers have an injurious effect on the biological conditions in the soil.

The biological conditions desired in the soil by farmers are those which are most suitable for the growth of agricultural crops, and we are still far from a full understanding of these. We know that the soil's population of micro-organisms and of larger living creatures is influenced largely by such factors as food supply, air,

moisture and degree of acidity of the soil. These things are to some extent within our control. One of the main sources of food for the soil population at large is organic matter, and, by breaking it up, the microbes of the soil render it fit for a later generation of plants to live on. In the course of their activities, these microbes break down complex organic compounds to simple substances, and amongst the substances thus produced are several identical with, or similar to, the nutrient materials supplied by fertilisers. We can multiply the numbers of bacteria and other micro-organisms in soil enormously by adding suitable organic material, but a mere increase in numbers is of no value in itself. Indeed, during the decomposition of organic matter rich in carbohydrates the increase in numbers of bacteria and other organisms makes a heavy demand on plant nutrients, especially nitrogen, and may starve an agricultural crop.

No evidence has been found to support the contention that fertilisers adversely affect the soil bacteria. The numbers of bacteria in plots at Rothamsted, which have received very heavy dressings of fertilisers for many years, are at least as high as in corresponding plots which have received no fertilisers. As might be expected, the numbers are greater in plots which receive organic manures, since bacteria are intimately concerned with processes of decomposition. Soil fungi also play a part in the decomposition of organic matter and there are mycorrhizae associated with the roots of certain plants, particularly coniferous trees and orchids, which promote their growth. There is no evidence that the application of fertilisers is injurious to these organisms in normal soils.

It has been claimed that fertilisers reduce the earth-worm population of the soil, but this is not borne out by work at Rothamsted, even on soils which have received abnormally heavy dressings of fertilisers, provided the soil has not been allowed to become too acid. The abundance of foods supplied by soils especially rich in suitable organic matter usually sustains a higher population of earth-worms and other small animals than the normal, but there is no evidence that an addition of fertilisers reduces the numbers in ordinary soil.

(b) **Effects on the Plant.** It has been alleged that fertilisers increase the liability of crops to insect, fungus and virus attacks, but, again, there is no sound evidence. No difference in level of infection with the fox-tail midge and two injurious wheat midges has been found at Rothamsted between the plots treated with fertilisers and with farmyard manure. Certain fertilisers, particularly superphosphate, have been shown to have a markedly beneficial effect in reducing the infestation of barley by gout fly.

Much of the work on plant pathology at Rothamsted deals with the effects of manuring on the incidence of disease, and there are both laboratory and field experiments in which organic manures and fertilisers are compared. The main work has been with root-infecting fungi. The effects of humus on the incidence of these is complex and varies with different fungi. Many root-disease fungi spend a part of their life-cycle as saprophytes on organic matter; most of these are saprophytic only in tissues which became infected while living, but some, for example, *Fusarium culmorum*, can

attack straw and other dead crop-residues in the soil. The latter type may be increased by adding organic material, whereas the former is reduced, for the development of antagonistic saprophytes on this added organic material suppresses the parasites.

The alteration in susceptibility of plants to fungal infection, through the addition of organic manures, seems to be mainly a nitrogen effect. The incidence of some fungal diseases, for example, eye-spot of wheat and Verticillium wilt, is increased with increased nitrogenous manuring, whereas the incidence of others, such as take-all of cereals, is reduced; it seems to be immaterial whether the nitrogen is applied in the form of organic manures or inorganic fertilisers.

Experiments are being made with potatoes and sugar beet to determine the effect of manuring on aphid infestation, and the resulting spread of virus diseases. The preliminary results show that the spread of virus diseases has been greater in crops of potatoes receiving dung than in others.

Another claim is that fertilisers have a detrimental effect on the composition and quality of the produce. The composition of crops is affected by manuring, and, whether organic manures or fertilisers or both are used, what is required is a proper balance to supply the plants' requirements and the nutritional needs of the animal or human consumer. There is no good evidence that organic manures have any special virtue or that properly balanced fertilisers, used under correct conditions, are detrimental.

Quality in crops is not easy to define and merits more thorough investigation, but the problem is difficult, involving, as it does, questions of flavour and palatability. It must also be borne in mind that quality is influenced by several other factors, such as moisture, temperature and sunshine, as well as by nutrients. Most of the attempts to approach the problem have been limited to determinations of the amount of dry matter, proteins, and the major mineral constituents and the estimation of a few vitamins, and this is, of course, not the whole story. The data on the effect of manuring on vitamin content are somewhat scanty and inconclusive, but there appears to be no reliable evidence to support a claim that vitamins are lower in crops grown with fertilisers. No attempt can be made here to deal with the literature on the subject, but it may be of interest to quote a few tests which have been made on produce grown at Rothamsted on land which, for experimental reasons, has received no organic manure for a very long period. The vitamin B_1 potency of wheat from plots of the classical Broadbalk field, which had received complete fertilisers annually, but no organic manure for over 90 years, was tested at the Dunn Nutritional Laboratories, Cambridge, and found to be at least equal to that of samples grown on a plot which had received annual dressings of farmyard manure over the same period. Barley from the classical Hoos field showed a slight difference in favour of farmyard manure in the 1935 crop, but the difference in the 1936 crop was not regarded as significant. Potatoes grown in a normal rotation were tested for Vitamin C and no significant difference was found between those receiving sulphate of ammonia and dung. Some preliminary work on the carotene content of carrots gave similar results.

Much is made of the fact that market gardeners producing "quality" crops make extensive use of organic manures, and it is therefore claimed that this long-continued and well-established practice justifies the belief that these manures have a peculiar and beneficial influence on quality. Because of the vagueness of the term "quality," it is difficult to prove or disprove such claims. It should be pointed out, however, that the value of organic manure is partly, and sometimes largely, attributable to its physical action on the soil. Market gardening is usually carried on in districts where the soil is sandy and free-working; this is desirable, not only to secure earliness of crop by being able to get on the fields at almost any time, but also to enable the crops to be lifted easily and relatively clean and free from soil. Such desirably light soil is, however, poor in nutrients and is also prone to dry out easily. For the latter reason alone it is good practice to add large amounts of organic matter, because it retains water, while keeping the soil workable. Most market gardeners, however, make use of fertilisers to supplement and balance organic manures and to encourage growth at particular times.

Organic manures of the hoof and horn type are favoured by many growers of "quality" crops, and this preference may, in large measure, be due to the fact that the nutrients are liberated over a long period of time, and the danger of over-supply in the early stages of growth is avoided without trouble to the grower. It is more difficult to attain the same effect with fertilisers, but some market gardeners are now applying them in small amounts in irrigation water. This method should give good control of the supply of both water and nutrients.

There appears to be no evidence that fertilisers when properly balanced are in any way harmful to "quality" crops, though, because of their concentrated character and rapid availability, they can be readily misused. The association, in the popular mind, of these crops with organic manures has arisen largely from the other consideration just mentioned, viz., the need to transform the sandy market-garden soil into a spongy bed, and, from the nutritional aspect, it seems immaterial whether the nutrients are applied as fertilisers or organic manures.

(c) **Effects on Animals.** Claims are often made that poor health and an increase of susceptibility to disease in farm animals and also in the human population have increased in consequence of the use of fertilisers. The increased attention given to health matters and improved methods of diagnosis have brought to light conditions which previously escaped attention, but most people would contend that the health, at any rate of the human population, is improving. In the case of farm animals, intensive breeding for high production has, in some cases, lowered the power of resistance to disease, and it is agreed that the health, both of human beings and farm animals, would benefit from better balanced diets. There is, however, no evidence that the use of fertilisers is in any way connected with disease. In fact, the evidence points the other way. In general, the principal deficiencies of soils in Britain are in lime and phosphate, and in some regions they are severe. Neither of these deficiencies can be remedied adequately by dung or compost made from produce grown on the farm; for the produce grown

on mineral-deficient soils will always be deficient in these elements unless they are supplied from outside. The deficiencies are not always evident. For instance, if a cow receives insufficient lime and phosphate, she reacts by robbing her own bones. Another instance is the disease in sheep, known in this country as "pining," and in New Zealand as "bush sickness." Sheep in certain regions suffer from this disease because their pasture, and the soil on which it grows, is deficient in cobalt; the "natural" manure produced on such land is also cobalt-deficient. The amount required is so small that a handful of a cobalt compound applied to an acre of land is enough to cure or prevent the disease. Probably similar deficiencies lie at the root of much positive ill-health and account for obscure troubles not quite justifying the name of disease. The lacking elements can be supplied as supplements to the food, but the simplest and probably most effective way is to apply them to the land. Many of our fields, and consequently, the animals fed from them, are short of mineral nutrients, so that the use of fertilisers can make positive contributions to animal health. There are "natural" excesses as well as deficiencies. The teart lands of Somerset provide an example. In these soils molybdenum is present in sufficient amount to cause scouring in cattle, and, in some parts of western North America, selenium is present in the soil to an extent that wheat and other crops not infrequently contain enough of that element to be poisonous to man and livestock. In such cases as these, organic manuring is no cure, for it merely keeps the toxic substances in circulation.

Balanced Manuring. As Dr. E. J. Salisbury, Director of Kew Gardens, stated in a recent article, "The presentation of manurial problems as a controversy concerned with organic manures versus mineral fertilisers is due to confusion of thought and complete failure to apprehend either the facts or the problem." It is generally agreed that organic manures are very beneficial and should be conserved and used as extensively as possible. Every farmer knows that they improve the physical condition of the soil, promoting good tilth, water-holding power, and aeration. At the same time, they provide nutrients both for plants and for the living organisms in the soil. Because these manures usually contain all or most of the elements necessary for plant growth, and are not too rapid in their action, their use is relatively safe even in the hands of the inexperienced. But although they contain a wide range of nutrients, these are often somewhat ill-balanced, and if the most effective use is to be made of them they must be supplemented by fertilisers.

Fertilisers lack the decomposable plant or animal constituents on which some of the most valuable properties of organic manures depend, but they have the advantage of providing plant nutrients in a concentrated and, in some cases, rapidly available form, and they can be applied very easily and at whatever times are considered suitable. Their variety also enables one or more nutrients to be selected at will to make good an imperfect balance or to provide a correct balance from the start. These properties lay them open to misuse in unskilled hands, but, in view of the large amount of research which has been done on the subject and the

advisory services available to farmers, gross mistakes are becoming less excusable.

As Dr. Salisbury points out: "It is possible to grow plants successfully and indeed sometimes more healthily on washed sand completely devoid of organic material, provided we ensure a constantly renewed supply of a dilute nutrient solution supplied in such a way that good aeration is maintained. Generations of plants have been raised by the method of 'soil-less gardening,' in recent years, and the water-culture method has been utilised with complete success in experimental stations, for many years, the world over. With efficient technique, plants grown in this way are often in no way inferior to those of the same kind grown in soil, and may be far freer from pests and disease."

The amount of organic manure available is insufficient for the needs of present-day agriculture and restriction of manuring to this would undoubtedly bring about a great increase in the cost of food and would lead to world famine. Farm organic matter can and should be supplemented by town wastes, such as garbage and sewage sludge, and much investigational work is being carried out on the preparation, manurial value and use of these materials. Sewage sludge, however, contains only a relatively small proportion of the nutrients and organic matter that are passed into the drains, the rest being dissipated in the course of sewage disposal and purification. The agricultural utilisation of the whole of the wastes of human origin would involve a mediaeval system of sanitation coupled with an ultra-modern thoroughness in the collection and transport of an unpleasant material. Nor would all that effort suffice to bridge the gap between the demand and supply of nutrients for crops of the size we expect to-day, for in most regions the release of mineral nutrients through the weathering of soil minerals is a slow process, and in all humid countries there are considerable natural losses in the drainage water.

Much stress has been laid on the special virtues of composts by those advocating the exclusive use of organic manures. The value of composts is generally agreed; composting, in many cases, is the most convenient way of returning crop residues to the soil, especially in market gardens. The process, however, involves a good deal of labour as well as losses in plant nutrients, and it is often more satisfactory and economical to plough down the materials and allow them to decay in the soil.

The maintenance of an adequate amount of organic matter in the soil is, of course, influenced greatly by the system of farming. Grass roots are particularly useful in promoting crumb structure and a good tilth, and, in temperate climates, very great benefit can accrue from ploughing down leys and catch crops. This is, in fact, one of the most important methods of maintaining a good organic matter status and it has beneficial effects on the soil which no other treatment can attain.

It has already been pointed out, however, that Nature has, in several places, omitted to provide in the rocks and soils sufficient amounts of all the major and trace nutrient elements; or these, if present originally, may have been reduced too far through cropping or leaching. Clearly, organic manures from produce grown on a

farm where these deficiencies occur can do little or nothing to make them good. Deficiencies of trace elements such as boron have often been staved off or remedied through the incidental occurrence of these elements in imported feeding-stuffs or as impurities in fertilisers. One of the important recent advances in agricultural research has been the recognition of trace element deficiencies. In some regions the substances lacking are now added to fertiliser mixtures.

A number of organic compounds have been discovered which, under certain conditions, stimulate root development in cuttings, and attempts have been made to show that organic manures owe some special virtues to such substances. Up to the present, however, there is no evidence that vitamins or other growth substances which may be present in organic manures increase crop yields or have any special nutrient effect, but the subject requires fuller investigation.

There is still much to be learnt about the principles of crop nutrition and the maintenance of soil fertility, but it is clear that organic manures and fertilisers both have their uses and should be regarded as complementary. Even in the production of organic matter for the soil, fertilisers play a highly important part, since the larger crops and better leys which they produce provide more material which can be converted into manure or ploughed directly into the land. Belief and assertion are no substitute for knowledge, and the propaganda of unfounded beliefs about the harmful effects of fertilisers is detrimental to the interests, not only of farmers, but of the whole community.

A Start in Book-keeping

By S. M. MAKINGS, Chief Agricultural Economist.

These notes are intended for the beginner in farm book-keeping and they outline a system designed to give a reasonable amount of information with a minimum of desk work. The aim in farm book-keeping should not be merely to arrive at the financial results of the year's work, but to provide also valuable information on the farm economy. The method outlined here should provide such information, but it is mainly intended to introduce the beginner to a simple system to serve as a basis on which to frame his own modifications as he begins to appreciate the uses to which he can put his farm accounting information. The general principles set out here are not standard rules, and the farmer should not hesitate to modify them in line with his own ideas and requirements.

THE OPENING VALUATION.

The first step is the opening valuation. Keeping accounts without a valuation is a waste of time, since the most accurate information of payments and receipts is not of much use unless the farmer knows what his stock was worth at the beginning of the year and what it is worth at the year end. The farmer can make his own valuation. His financial year will begin as from the date of the valuation, and if the accounts are to be used for tax purposes it is convenient to start as from the end of March or beginning of April. To make the first valuation, the farmer should write out a complete inventory of his livestock, equipment, produce on hand, fertilisers, seeds, stores, etc. There is no need to value the land or the farm house, but such structures as tobacco barns, pumps and tanks, fencing and so on can be included. This first valuation is a biggish job on a large farm, but it will not have to be repeated in detail.

The values to be used in the first valuation should be carefully considered, since they will serve as a basis for future valuations. It is unwise to value everything at market value because a lot of the stuff is not for sale, and if market values are used, the fluctuation of prices from one year end to another may result in fictitious profits or losses shown by the accounts. Market values are a good guide and may be used, with modifications, for livestock and produce which is about ready for sale and as the basis for a more conservative estimate of the values of breeding and working stock. For equipment and structural assets a good basis is that of cost less depreciation, but here too the general rule may have to be modified. General principles for the first variation are:—

Livestock. Breeding stock, dairy stock, young stock not for sale and draught oxen, all at market value less 20 per cent. Animals shortly for sale, at market value less 10 per cent. (This 10

per cent. is to allow for cost of marketing, risk and keep to date of sale.)

Equipment. Tractors and farm car at cost less 20 per cent. for each year since purchase. All other farm machinery and equipment (including fixed engines and mills) at cost less 10 per cent. for each year since purchase. In making the first valuation this rule with reference to equipment may have to be modified for some items. For instance, a farm car which cost £350 in 1939 might well be worth £200 in the market to-day; it would be reasonable to value it at (say) £170 for this first valuation. Thus the general rule for equipment could be modified in respect of all items bought more than five years ago by taking market value less 15 per cent. per annum for those items.

Structural Assets. The general rule should be cost less 5 per cent. per annum from date of purchase or completion, but here again the rule could be modified for some items (where there has been strong appreciation in values) as with equipment.

Produce on Hand. This should include all crops harvested for sale but not yet sold, and the value should be market price less cost of marketing and an allowance for risk (risk of storage loss or damage and risk of a price decline). Hay and fodder can be valued on the same basis if sales are anticipated; if not, it can be omitted. There is no need to value growing crops and workings for financial account purposes on the ordinary farm. Apart from the work involved in such a valuation, it would be of dubious value, and where there is no great change in farming system year by year it can be reckoned that the closing value of growing crops and workings is approximately the same as the opening value. Thus they can be allowed to cancel each other out.

Manures, Seeds and Stores. Artificial manures in stock, seeds not sown, purchased feeding stuffs in store and such items as paraffin and petrol stocks, livestock medicines and wire should be valued at cost on to the farm.

Small Tools and Sundries. A reasonable estimate of the value of these items should be made.

DEBTORS AND CREDITORS.

Having made the valuation, the farmer should make a list of his debtors and creditors as at the same date. The money he owes and the money owing to him is really concerned with transactions of the previous financial year, but, since it will be entered in his new accounts when paid or received, he will need a note of the amounts outstanding so as to be able to adjust the accounts at the end of the year.

RECORDING.

As from the date of valuation, the farmer should keep a record of all farm payments and receipts. This account is concerned only with payments and receipts in connection with the farming business. It should not include housekeeping expenses, medical bills, clothing, other personal expenditure, school fees and so on, as

these items are not part of the farming costs. The rule governing the entry of expenses should be that no expense is entered unless it was incurred for the purposes of the farming business. There are some expenses which are for both private purposes and farming purposes, such as car expenses, power for the water supply, telephone charges, etc. The simplest way to deal with such items is to enter them as farm expenses throughout the year and at the end of the year to deduct an amount estimated to cover the non-farm part of the expense. For instance, if it is estimated that one-third of the use of the car during the year was for private purposes, then one-third of the cost of petrol, oil, car repairs and depreciation should be taken off the car expenses charged to the farm. A more accurate method is to keep records of non-farm use under these headings, but this involves more booking than is absolutely essential. After the farmer has got into the habit of booking he may decide to keep a record of this sort for a time (say, for six months) to get a sound basis for his end-of-the-year estimate.

Payments are usually made by cheque and by cash. Cheque payments can be entered from the cheque-book counterfoils (which should always carry a note of what the payment was for). Cheques drawn by a farmer will fall under three headings: those representing farm payments and nothing else, such as payments for seed, fertiliser, new equipment and so on; those representing private expenditure, such as doctor's bills, school fees, furniture, etc.; and those representing mixed expenditure, such as some of the grocery bills, chemist's bills and hardware bills, including both items for the house and items for the farm. Payments under the first heading are, of course, entered in full and payments under the second heading are omitted. Those payments which represent mixed expenses have to be split up; thus, if the farmer has paid by cheque a grocery bill which included items for the farm as well as the groceries for the house, he will need to get out the bill, enter the cost of the various farm items into his farm account, and omit the rest. Similarly with other mixed expenditure.

In entering expenses from his cheque-book counterfoils the farmer will come across cheques drawn for cash. Periodically he cashes a cheque to get money for wage payments and incidental expenses, both farm and private. The amounts of these cheques should not be entered in the farm accounts. So far as that part of the cash used for farming purposes is concerned, it will be entered as and when the cash payments are made.

The rule with reference to cash payments is the same as that for cheque payments. Thus only cash payments made for farming purposes should be entered in the farm account. It is a good plan to jot down sundry cash payments in a pocket-book and to copy them into the farm account book from time to time. Suppose, for instance, that the farmer has cashed a cheque for 50 pounds for running expenses and has used the money as follows: £7 5s. for sundry farm tools bought for cash, £2 10s. paid cash at the chemist for cattle dip, £2 5s. paid cash for repairs to car trailer, £30 paid farm boys' wages, and £8 spent for personal items: the first three items (jotted down in his pocket-book at the time) would be copied from there into his farm account, the boys' wages would be entered

in the labour book and transferred from there to the farm account, and the personal expenditure would be omitted.

Reference has been made above to a labour book. Every farmer ought to keep a labour book in which his farm boys are listed, their work booked daily or weekly, and their wages reckoned monthly. The monthly total of the wages, plus the cost of rations, is then posted to the farm account.

The farm account book should not be a complicated affair. A plain cash book with single cash rulings, foolscap size, is excellent. It is a good idea to get a fairly slim book and have a new one each year, as any book begins to look the worse for wear after a year's entering.

The system of entering can be quite simple. Just book all payments on the left-hand page and all receipts on the right-hand page. It is convenient to have the entries in monthly summaries, starting a new page for each month. At the end of the month the entries might look something like the following:—

PAID—JANUARY.

Date.		£	*s.*	*d.*
4.	Brown & Co., 20 tons fertiliser (cheque)	300	0	0
	Green Bros., tractor repairs (cheque)	22	10	0
	Smith, 18 heifers (cheque)	206	0	0
7.	White & Co., plough fittings	4	13	6
12.	Car, petrol	1	12	6
	6 hoes, 4 buckets	2	4	0
13.	Farmer's licence (cheque)	2	0	0
	Fire insurance (cheque)	22	15	0
	Stock insurance (cheque)	14	12	6
16.	Wilson, fencing wire (cheque)	27	0	0
21.	Transport Co., haulage (cheque)	17	4	0
	Black, 6 store pigs	24	0	0
24.	Petrol for car	1	12	6
27.	Gray, 10 bags seed beans (cheque)	25	0	0
31.	Boys' wages	45	12	0
	Butcher, boys' meat (cheque)	8	11	6

RECEIVED—JANUARY.

Date.		£	*s.*	*d.*
6.	C.S.C., 12 baconers (cheque)	96	12	0
7.	Black, 8 draught oxen (cheque)	96	0	0
24.	R.M.C., 200 sacks wheat (cheque)	350	0	0
27.	Co-op., 1,120 galls. milk (cheque)	112	0	0
30.	Jones, old plough	12	0	0

Two points should be noted in connection with the foregoing example: First, every entry should show who the money was paid to or received from, and just what the payment or receipt was for. This information can be extremely useful in checking up later. Second, cheque payments and receipts are so marked. This makes it easy to tick off all cheque transactions against the bank statements, and any omissions can be made good. In some book-keeping systems there are separate columns for bank and cash items and in other systems a separate petty cash book is kept, but both these devices have been avoided here for the sake of simplicity.

A matter which is apt to confuse beginners is the question of contra accounts. Where a farmer has buying and selling transactions with the same firm, his purchases may be offset against his sales, and he would then receive or be required to pay the balance. Suppose, for instance, he has bought 20 tons of fertiliser for £300 and 5 tons pig food for £112 from Brown & Co., and that he has sold Brown & Co. 200 sacks of wheat for £350. The statement he gets from Brown & Co. will list these items and will show that he owes £62, and so he makes out a cheque for £62. If this is entered in the farm account as "Brown & Co. (cheque) £62," the account will be quite accurately balanced, but all the information essential to worth-while book-keeping will be lost. At the end of the year his accounts will not show how much wheat he sold, or how much fertiliser or feeding stuffs he bought. All this information should be available from the account book, and a simple way to make it available is to enter the transaction as follows:—

PAID.		RECEIVED.	
Date.	£	*Date.*	£
3. Brown & Co., 20 tons fertiliser	300	3. Brown & Co., 200 wheat	350
5 tons pig foods .	112	P/C ferts & pig food £412.	
Wheat P/C £350.			
Cheque £62.			

No item should be entered into the account book until it is paid or received. It is a good plan to have two running files for bills, one for unpaid bills and one for paid bills. The farmer may also find it useful to rule a vertical column alongside each cash column in his account book and to put a reference number in that column and on each bill as paid: thus the reference 4/7 could indicate that the bill in question was entered as item 7 on page 4 of the account book. Bills should be placed in the paid file in order of payment for easy reference and the file should be such that a bill can be referred to without taking it out of the file.

CLOSING VALUATION.

Assuming that the farmer has kept a good account throughout the year, his remaining chief requirement as a basis for a financial statement is the closing valuation. This valuation is less comprehensive than his opening inventory. Again, he will need to list all his livestock, produce, purchased foods, fertilisers, seeds and

stores on hand; but there will be no need to make a detailed inventory of equipment or of structural assets. The procedure may be as follows:—

Livestock. Having listed the numbers of the various classes of animals, the breeding stock and draught oxen are valued on the basis of the rates used the previous year (where market values are increasing or decreasing steadily year by year the basic rates might well be modified after the second consecutive year of change). Again, if the animals in these categories are now of substantially different quality, or if high or low cost purchases have been made, the valuation rates may be adjusted accordingly. All stock likely to be marketed during the coming financial year are valued by the method used for this class in making the opening valuation.

Produce on Hand, Purchased Foods, Fertilisers, etc. These are all valued on exactly the same principle as in the opening valuation.

Equipment. Here the method merely involves adjustments to the total equipment figure in the opening valuation. The value of the equipment can now be assessed by adding to the opening valuation any purchases made during the year and by deducting any sales and applying the appropriate rates of depreciation. Suppose the opening value of equipment was £1,250 (including a tractor at £200 and a car at £320), that purchases during the year yere 1 tractor, £380, 1 tractor cultivator, £50, and 1 tractor plough, £75. During the year an old plough was sold for £12. Then the closing value of equipment is arrived at as follows:—

	Car and Tractor	Other Equipment	Total
	£	£	£
Opening value	520	730	1,250
Add purchases	380	125	505
	900	855	1,755
Deduct sales	—	12	12
	900	843	1,743
Less depreciation	180	84	264
Closing value	£720	£759	£1,479

DEBTORS AND CREDITORS.

Having made the closing valuation as at the date of the end of the financial year, all that is now required to enable the farmer to make up a statement of account is a list of debtors and creditors on current accounts at that date.

THE FINANCIAL STATEMENT.

To arrive at a simple statement of profit or loss the general principle is that if the farm sales during the year, plus the closing valuation, exceed the payments plus the opening valuation, then the difference is profit. If the payments plus opening valuation exceed the receipts plus closing valuation, then, of course, the difference is loss. Thus, if the opening valuation was £3,000, payments £3,000, sales £3,500, and closing valuation £3,500, there would be a profit of £1,000, shown thus:—

Opening valuation	£3,000	Receipts	£3,500
Payments	3,000	Closing valuation	3,500
Profit	1,000		
	£7,000		£7,000

The foregoing skeleton statement is not quite valid as it stands, since no adjustment has been made for debtors and creditors on current accounts at the beginning and end of the financial year. In making these adjustments it may be kept in mind that if the money owing to the farmer is greater in amount than the money the farm owes, then the balance is an asset just as the items which make up the valuation are assets, and so that balance should be entered on the same side of the account as the corresponding valuation. If the farmer owes more than is owing to him, the balance is a liability and must be entered on the opposite side to the corresponding valuation. For example, assume that at the beginning of the year the farmer owed £200 and had £100 owing to him: his net liability would be £100 and he could adjust his financial statement at the end of the year by entering that amount on the right hand side. Suppose also that at the year end he owed only £80 and had £150 owing to him: the difference of £70 would be his net asset on unpaid accounts and he could adjust his statement by entering it on the same side as his other assets (i.e., his closing valuation), again the right hand side. As both items have to go on the one side of the statement they may be combined and entered as "adjustment for debtors and creditors." The modified statement would then be as follows:—

Opening valuation	£3,000	Receipts	£3,500
Payments	3,000	Closing valuation	3,500
Profit	1,170	Adjustment (Dr. and Cr.)	170
	£7,170		£7,170

A skeleton statement such as the foregoing would show the farmer the amount of his profit or loss, but it fails to make use of the valuable information contained in his account book. To be of value, the financial statement should show the direction of the year's expenditure and the main sources of income, and this enables useful comparisons to be made year by year. A useful sort of financial statement, giving informative detail, may be drawn up on the following lines:—

FINANCIAL SUMMARY, YEAR ENDING MARCH 31st, 1948.

Valuation at 31/3/47:	£	£
Livestock	850	
Equipment	1,750	
Produce on hand	640	
Fertilisers, stores, etc.	320	
	——	3,560
Payments:		
Feeding stuffs	250	
Fertilisers	180	
Seeds	90	
Repairs	120	
Fuel and oil	80	
New equipment:		
Tractor	430	
Plough	65	
Vet. and medicines	32	
Fencing wire	70	
Wages and rations	460	
45 store cattle	540	
1 boar pig	15	
Sundries	75	
	——	2,407
Profit		593
		£6,550

Receipts:	£	£
1,500 bags maize	1,875	
50 bags wheat	105	
32 fat cattle	610	
24 baconers	160	
	——	2,750
Valuation at 31/3/48:		
Livestock	900	
Equipment	1,950	
Produce on hand	420	
Fertilisers, stores, etc.	300	
	——	3,570
Adjustment for Dr. & Cr.		230
		£6,550

In order to make up such a financial statement the farmer must make an analysis of his cash book, but this is not a difficult matter. A good method is to take a large sheet of paper and rule it into about 15 columns, heading each column with the item class as it will appear in the financial statement. Thus there would be a column each for fertilisers, feeding stuffs, seeds, repairs, fuel and oil and so on according to the amount of detail wanted in the financial summary. The payments would then be gone through item by item, with the amount of each item placed in its appropriate column. When all the items had been extracted in this way the sum of their totals should, of course, equal the sum of the page by page additions in the cash book, and this method provides a useful check against the accuracy of the analysis. The receipts are analysed in exactly the same way, and the two analysis sheets, together with the valuation summaries and the lists of debtors and creditors, provide all the information needed for the financial summary.

Control of Poultry Parasites

By A. A. REED, Assistant Poultry Officer.

As the presence of parasites in a flock does not usually result in the death of birds, poultry farmers very often do not realise that their flock is infested until the infestation has become severe. By this time the parasites may have already caused a loss of vigour, reduced production, or stunting of growth in young birds. Some parasites may also transmit disease and are an additional danger in this respect.

Poultry are usually kept in relatively large numbers and are concentrated on a small area. Thus infection spreads very rapidly through a flock, unless checked, and as most parasites have a very short life-cycle, especially in summer, they build up their numbers very quickly.

Apart from the direct economic losses caused by the parasites, the treatment and handling of the birds to rid them of the infestation may upset them still more, while in the case of tapeworms no effective treatment is known. Thus prevention is much more important than treatment in controlling parasites.

The parasites of poultry fall into two groups, internal parasites and external parasites, for which prevention and remedial treatment are quite different.

1. INTERNAL PARASITES.

The most important and widespread internal parasites are the large round worm found in the small intestine, the small round worm, or "caecal worm," found in the blind guts or caeca, and tapeworms of different species found in the small intestine.

Worms absorb a certain amount of the food eaten by the bird, but they do more damage by irritating the wall of the intestine, so causing enteritis. The inflamed and thickened intestine is not as capable of digestion and absorption. Worms also give off poisons, one of which causes anaemia, so that affected chicks are pale about the face, comb and wattles. Another affects the nervous system. Thus, even after treatment for worms, badly infested flocks may fail to improve in condition.

(a) **The Large Round Worm.** The large round worm is white or yellowish in colour, tapered at both ends, and from one to four and a half inches in length when fully grown. It is found in the small intestine, and may occur in such large numbers that it blocks the intestine almost completely.

Chickens are very quickly affected by round worms, and show general unthriftiness, paleness of face, comb and wattles, drooping of wings, and emaciation. A very heavy infestation may kill young

chicks in from 10 to 12 days. Older chicks are more resistant to the parasite, and if the bird is not infected until it is over four months old, the round worm will do less damage. Full-grown fowls may be heavily infested before any symptoms are noticed, but they then become unthrifty and egg production drops. The lowered vitality makes the birds more susceptible to colds and roup, which are often found with heavy worm infestation.

A definite diagnosis can be made by slitting open the intestine behind the gizzard with a scissors, and examining for worms. As a routine measure all birds which die or which are killed for table should be examined as a check. Worms will also be noticed in the droppings where infestation is heavy.

The round worm lays very large numbers of eggs which pass out in the droppings. Under dry conditions and in direct sunlight the worm eggs only survive for a few hours, but in shaded, damp spots, they may live up to a year.

The newly-laid worm egg is not infective to a fowl swallowing it immediately, as the young stage of the worm has to develop in the egg on the ground, which takes eight days to three weeks. When a developed egg is swallowed, the worm hatches out in the bird, and grows to maturity in about two months. No increase occurs in the intestine, except from more eggs eaten by the bird.

Prevention. As young stock are most susceptible to round worms, every effort should be made to rear them on uncontaminated ground away from adult birds. The rearing pens should be used only for chicks, and should be on high ground to prevent washing of worm eggs from adult pens by rain. If possible, two or three pens should be provided so that chicks are not reared on the same ground each year. The pens can be grazed or used for crops when vacant. Low-lying and damp places in the runs should be filled up or drained, and dampness round the water vessels prevented or screened off by a frame covered with wire-netting. Droppings from adult birds should never be used to fertilise these pens.

When ground is known to be infected, it should be rested for a year and clean-cultivated regularly. High temperatures will kill the eggs in unshaded soil, hence no crop should be grown.

In the case of adult birds, infection will be kept down by cleaning out the droppings daily, and changing the litter regularly. No disinfectant at normal strength will kill worm eggs, but if the pen is thoroughly cleared out every week, the eggs will not have time to become infective.

Alternate runs should be provided if the birds are kept semi-intensively, and used in rotation. Birds use the runs mostly round the exits from the house and make holes in dusting themselves from which they drink when it rains. Coal cinders or wood ash, if available, should be used to cover these areas regularly.

All birds brought on to the farm should be isolated and dosed for worms before being put with the flock.

Treatment. Individual treatment consists of dosing each bird with carbon tetrachloride alone, or mixed with an equal quantity

of liquid paraffin. The dose is $\frac{3}{4}$ c.c. of carbon tetrachloride per pound body weight, but with a maximum dose of 4 c.c. of carbon tetrachloride. Chicks under six weegs should not be dosed.

Birds should be starved for 12 hours before dosing. A simple method of dosing is to attach a 6-inch length of thin, low-pressure rubber tubing to a graduated syringe. The tube is pushed down into the crop, being careful not to insert it into the windpipe. The required dose is then injected into the crop. If a mixture of carbon tetrachloride and liquid paraffin is used, it must be thoroughly stirred each time the syringe is filled.

The treated birds should be kept in the house and not allowed the run for two days after dosing. All the litter should be removed and burnt, or distributed on a part of the farm far from the poultry. One treatment should be sufficient, but it will upset production, and should preferably be given to pullets before they start laying, or to hens at moulting time, if infestation is suspected.

A flock treatment may also be given, but is not so satisfactory, as very heavily infested birds may not eat enough mash to get a sufficient dose.

Tobacco dust containing not less than 1.5 per cent. or more than 2.5 per cent. nicotine is mixed at the rate of 2 per cent. in the mash. This is fed for three weeks, left out for three weeks, and repeated again for another three weeks. Epsom salts at the rate of 1 lb. per 100 adult birds should be given after the first week, and at the end of each treatment. Tobacco dust will lose 14 per cent. of its nicotine content each month it is exposed to air, thus it should be stored in an airtight tin, and only sufficient mixed in the mash to last a week at a time.

(b) **The Caecal Worm.** This is a small round worm found in the caeca or blind guts of poultry. The full-grown worm is from three-tenths to one-half inch in length. Fowls are not usually heavily infested. It is of considerable importance to turkey farmers overseas, as it is responsible for transmitting the organism causing blackhead in turkeys. Dr. Canham has recently identified blackhead in turkeys from East Griqualand, so that the disease has now reached South Africa. Blackhead is very common in America and Europe, where fowls harbour the disease, which does not affect them severely. The eggs of the caecal worm from infected fowls carry the organism, and if picked up by turkeys, will give them blackhead.

The prevention of caecal worm infestation is the same as for other round worms.

Flock treatment with tobacco dust will remove about 80 per cent. of caecal worms.

Individual or flock treatment with phenothiazine is very effective. The individual dose is $\frac{1}{2}$ gramme per fowl, for half-grown turkeys 1 gramme, and large full-grown turkeys 2 grammes. In flock treatment, mash is removed the previous afternoon and 1 oz. phenothiazine mixed thoroughly in 5 lbs. of mash for every 50 fowls is fed the next day.

(c) **Tapeworms.** Tapeworms are long, flat worms, made up of a head or scolex, and a number of segments or joints. The head is embedded in the lining of the intestine. Different species of tapeworm may infect poultry, and vary from semi-microscopic size to 10 inches in length.

Tapeworms produce similar effects to those caused by round worms, but the symptoms are usually more severe. Chickens are also more affected than adult birds, and in heavy infestations may show leg weakness.

A definite diagnosis is the presence of flat segmented worms attached to the wall of the intestine. As some species are very small, it is advisable to wash the intestine and examine the wall carefully. Nodules are sometimes formed on the wall of the intestine, due to the irritation of the parasite.

Fresh segments are continually being formed behind the head of the tapeworm; these grow and become full of eggs, and when they mature, the end segments break off and pass out in the droppings.

The tapeworms of poultry require a secondary host in which the "measle" or bladder stage can develop. Different species of tapeworm have different hosts, and common ones are stable, and houseflies, snails and slugs, earth worms, ants, and dung beetles. These take up the tapeworm eggs, and the bladder stage develops in their bodies. When they in turn are swallowed by poultry, the larval tapeworm is set free in the intestine, where it attaches itself to the lining and starts to grow segments.

Prevention. Poultry droppings should be removed daily and the litter changed regularly to reduce fly attraction. The poultry manure should be removed to a distant part of the farm, or stored so that flies cannot breed in it.

D.D.T. should be used as a regular spray, especially on brooder house walls, as young chicks are active in catching flies.

Water vessels should be raised from the ground and the surrounding area kept dry, so that snails and earth worms are not attracted. All damp spots in the run should be drained or filled up, and loose stones, pieces of tin or plank which might act as cover for snails or earthworms should be removed.

Treatment. There is no known drug which will kill an appreciable number of tapeworm heads, as they are protected by the lining of the intestine in which they are embedded. Some vermifuges will remove the segments, but fresh segments grow again. Hence, treatment is of no value in removing tapeworm from poultry.

2. EXTERNAL PARASITES.

External parasites multiply more rapidly during hot weather and are checked by very low temperatures. Rhodesia, with its hot summers and mild winters, is thus very favourable to their development.

As most chicks are hatched in incubators to-day and reared artificially, it is possible, by strict sanitation and by rearing them away from adult birds, to keep them very free of external parasites.

Houses should always be thoroughly cleaned, disinfected, and all woodwork painted with carbolineum before young stock are put in them. D.D.T. and gammexane have also made the control of external parasites much easier.

All birds introduced on to a farm should be carefully examined and, if necessary, treated before being put with the flock.

(a) **The Fowl Tick.** These are frequently called "tampans," but true tampans are found mostly in very dry areas and usually shelter and moult in the ground. The true tampan may also attack poultry. The fowl tick is the most difficult to exterminate of all external parasites, and is also responsible for transmitting spirochaetosis where infected birds are present. This disease is usually fatal.

The irritation of the ticks causes restlessness, lack of sleep, anaemia and emaciation, and even death, especially in young birds. A mild infestation may cause unthriftiness, poor egg production, and lack of vitality. An outbreak of spirochaetosis would indicate that either fowl ticks or red mite were present.

Fowl ticks are not easy to find, as the nymphs and adult ticks hide during the day in cracks in the wall and woodwork, behind loose plaster or limewash, in nest boxes, and under the loose bark of trees. They are oval-shaped ticks, with flattened bodies unless engorged, and greyish or reddish brown in colour. They are best searched for with a pocket-knife, inserting it deep into all cracks and crevices, and examining it for blood. Only the larval stage of the fowl tick remains on the bird, usually for four to ten days, before it leaves to hide. The larvae may be seen as small reddish-purple dots on the breast, under the wings, and on the thighs.

The female tick lays eggs in batches of 20 to 100 in its hiding place. The eggs hatch in two to four weeks, depending on the temperature, and the six-legged larvae seek a bird and attach themselves and suck blood. After four to ten days they leave the bird, find a hiding place and moult, to become an eight-legged nymph. They then come out to suck blood at night, and return to their hiding place. The first nymphal stage lasts about three weeks, after which they moult again into the second nymphal stage, and after another five weeks they moult into adults. The complete life cycle takes about ten months. The adult tick feeds about once a month, but the female more frequently than the male, and after each feed she lays a batch of eggs.

The larva is able to live seven or eight weeks without food, but nymphs may remain alive for a year, and adult ticks for two to three years. In the absence of fowls, ticks may feed on turkeys, ducks, geese and wild birds. In ducks and geese the bite of a fowl tick causes lameness.

Prevention. The fowl tick is often brought on to a clean farm when birds carrying the larval stage of the tick are introduced. Thus all new birds should be carefully examined for their presence. A good system is to isolate all introduced birds in a cheaply made wooden crate for 12 days, by which time any larvae will have dropped off and hidden in the wood. The crate should then be burnt.

Crates returning to the farm should be sprayed thoroughly with any of the sprays recommended under treatment.

Wild birds should not be allowed to nest in or around poultry houses.

Poultry houses should be constructed to give the minimum cover to fowl ticks. Concrete, brick or corrugated iron walls are the safest. Brick walls should be sack-rubbed with cement to close all cracks. Whitewash is not satisfactory, as in many cases it flakes or cracks and gives shelter to ticks. Thatched roofs are dangerous. The minimum of timber should be used in the house, especially round the perches. All timber should be as free of cracks as possible, and should be treated with hot tar, carbolineum or sump oil before use, and painted regularly. The perches can be hung from the roof on wires round which small tins are soldered, and kept filled with dip or paraffin. The perch frame must not touch the wall at any point. Nest boxes should be removed regularly and sprayed. Old planks and pieces of wood, bricks, etc., lying in the run should be removed.

Trees with rough bark should not be planted in poultry pens.

Treatment. When ticks are found, treatment must be carried out thoroughly, and for a long period, to ensure that all are killed. Fowl ticks are extremely difficult to exterminate.

Where the woodwork in the house is old, rotten or badly cracked, or riddled with white ants, or the roof of thatch, treatment will not be successful. If the roof is of corrugated iron or asbestos, this can be salvaged and the house burnt down, using dry grass if necessary to make sure that all ticks are killed. The corrugated iron or asbestos should be thoroughly cleaned and sprayed before it is used again.

Fowls removed from such a house should be isolated for 12 days in a new rough wood and thatch shelter, which must, however, be absolutely free of fowl ticks. When the birds are removed after 12 days, the larvae will have all dropped off, and the shelter is then burnt to the ground. Alternatively, the birds may be thoroughly dipped in a solution of 2 per cent. wettable D.D.T. powder to kill the larvae.

Where the house can be treated, it is first thoroughly cleared out and all litter, nest material and dirt are burnt just outside the house. All crevices and cracks in the house should be filled up with hot tar, carbolineum, or sump oil, and all woodwork should be thoroughly painted with carbolineum or sump oil, giving special attention to cracks and joints. A blow-lamp can be used to kill ticks hiding between corrugated iron or other metal work in the house.

The house must be sprayed regularly until no ticks can be found after the strictest examination. Sprayings should preferably be at five-day intervals, but not more than ten days apart. At least four should be given, but up to ten sprayings may be necessary. Even after that, thorough examinations should be made at intervals. Trees with rough bark near the house should be chopped down and burnt, or the loose bark should be removed and the trees

sprayed each time the house is sprayed. All wooden fence posts should be painted with carbolineum and sprayed.

The following sprays are recommended:—

Cut up 1 lb. of soap and boil in two gallons of water. When dissolved, remove it from the fire and add four gallons paraffin. This mixture should be thoroughly agitated by pumping through a spray pump for five minutes, or with a paddle for ten minutes, until a uniform creamy liquid is formed. This is the stock solution, which will keep indefinitely. To make a ten per cent. solution, add six gallons of water to each gallon of stock solution. Just before spraying, add ½ oz. 40 per cent. nicotine extract per gallon and mix well. The paraffin kills the ticks by contact, while the nicotine fumes will reach those not touched by the spray.

Gammexane can be used as a spray, and all stages of the fowl tick are susceptible to contact with surfaces sprayed with it. D.D.T. emulsion, while successful in killing the larval stage of the tick, is apparently not capable of killing all nymphs and adult ticks, and therefore will not ensure complete extermination of the fowl ticks.—(Annual Report, 1945/46. Queensland. Page 41.)

(b) **The Red Mite.** Red mites are more common than fowl ticks, and as they are so small and breed so much faster, they often build up to serious proportions before they are noticed. The poultry farmer may first become aware of them when he finds one or two on himself, on collecting eggs or working in the fowl house.

Symptoms are the same as those produced by fowl ticks: the birds become droopy and weak, with pale combs and wattles. Sitting hens may leave their nests, or are sometimes found dead on the eggs. An outbreak of spirochaetosis points either to red mites or fowl ticks being present.

As red mites are so small and feed mainly at night, they are not readily noticed. A few red mites may sometimes be seen on a fowl during the day, and mites will also attack laying hens on the nest boxes. Mites are only red when engorged with blood; before feeding they are greyish white in colour. They are found hiding in cracks and crevices near or under the perches, or in the nest boxes. If present in large numbers, mites will be found in clusters in suitable hiding places. "Salt and pepper" markings, the droppings of the red mite, will also be seen on the woodwork. Their moulted skins may sometimes be seen as a fuzzy white powder near their hiding places.

The life cycle is similar to that of the fowl tick, but very much quicker. In summer, the whole life cycle takes only a week. The adult mite can live at least four months without food. In the absence of fowls, they will attack turkeys, pigeons and other birds. Sparrows have been known to spread red mite.

Prevention. This is the same as for fowl ticks. As a few mites may stay on a bird during the day, introduced stock should be isolated for two days before being put with the flock. The writer has seen red mites on pullets arriving at an egg-laying competition.

A limewash used in America for the interior of poultry houses consists of 5 lbs. D.D.T., 2 quarts 50 per cent. formalin, 75 lbs. fine slaked lime, and 50 gallons of water.

This will help to keep the house free of red mites.

As a check on red mite infestation, a loop of wire can be attached under a perch in each house. A small ball of cotton wool is inserted on the loop and inspected regularly. Red mites can easily be seen against the white background.

Treatment. The South African Poultry Association report that a single treatment with D.D.T. was completely effective in exterminating red mite in a very severe outbreak, where clusters of mites ½ to 1½ inches long hung under the droppings board, and where the litter was alive with mites. Approximately 1 oz. of D.D.T. powder was sprinkled in each nest. All woodwork and walls at the back of the house were thoroughly sprayed with a 5 per cent. D.D.T. in paraffin. All litter was left in the house, as the lightest breeze might have blown red mites and eggs to other pens had an attempt been made to move the litter. D.D.T. has a residual effect, and as fresh mites hatched they were killed when they came into contact with D.D.T. Up to ten days after the spraying red mite were still seen, but in diminishing numbers, and after 14 days there were no further signs. After six weeks no red mites had reappeared.

(c) **Scaly Leg Mite.** This mite causes scaly leg, which is very common, especially when birds are kept under insanitary conditions. Heavy breeds seem more susceptible than light breeds.

The mite causes itching and discomfort, and the affected birds lose sleep, become weak and may stop laying.

The scaly leg mite works its way under the scales of the toes or shanks, and bites the skin underneath. Serum exudes, and the mite feeds on this. After a short time the scales become raised and a whitish powder is seen, sometimes mixed with exuded serum. In extreme cases the exudate may entirely cover the scales, the bird may become lame, and toes may be lost. Very occasionally the comb and head may be affected. Fowls, turkeys and cage birds are attacked, but not water fowl.

The adult female lays her eggs under the scales, and the larvae when hatched make burrows of their own. They undergo moults until the adult stage is reached. Mites also travel along the perch and attack other birds. Scales are infected for up to 30 days, and the mite may live in filth, nest boxes, or on perches for the same time.

Prevention. The rearing of chicks separately from old birds and the cleaning and disinfecting of all houses before chicks are put into them will keep them free of the parasite.

Affected birds should be immediately isolated and treated before being restored to the flock.

The regular painting of the perches with carbolineum will prevent infection along the perches at night.

Treatment. Before treating an infected bird, it is necessary to scrub the legs in soap and warm water, with a nail brush, to remove all loose scales and crusts, which protect the mite.

An ointment made with 1 part oil of caraway to 5 parts of vaseline, or of 1 part sulphur to 9 parts lard, can then be rubbed in, and repeated every few days until a cure is effected.

When large numbers are attacked, the legs may be dipped in a mixture of equal parts of paraffin and sump oil, being careful not to get the mixture on the skin above the hock joint, as it might cause severe burning.

(d) **The De-pluming Mite.** De-pluming itch or de-pluming scabies is not very common. The de-pluming mite burrows under the skin at the base of the feathers, which become brittle and break off, or due to the itching the fowl may pull them out. Affected birds become bare first on the rump near the tail, then on the back, neck and head, while in extreme cases the feathers may be lost from the thighs and breast, and only the main wing and tail feathers remain. Infestation usually appears in spring, becomes worse in summer and almost disappears in the winter.

The irritation may not only cause birds to pull out their own feathers, but they may feather pick other birds as well. De-pluming itch can be distinguished from ordinary feather picking or moult by examining the stub of the feather soon after the quill has dropped. Scales and crusts will be found round the stump, and if adjoining feathers are pulled out, they will also be affected.

The mites spread from bird to bird by contact, either on the roosts at night or by the male birds when mating.

Prevention. Careful examination of all new birds and their treatment, if necessary, before putting them in the flock will prevent the parasite being introduced.

Treatment. As de-pluming itch is very contagious,; infested birds should be isolated immediately and the perches painted with carbolineum or sump oil.

Individual birds can be treated with sulphur ointment, vaseline and carraway oil, or by dusting the birds thoroughly with sodium fluoride or D.D.T. powder. Where the whole flock is affected, dipping may be more satisfactory, but it is undesirable with laying stock, as it may reduce production and cause colds, unless carried out on a warm sunny day.

A recommended dip is made up of 2 ozs. soft soap, 4 ozs. sodium fluoride, and 6 ozs. of sulphur to 4 gallons of water. The soft soap is dissolved in hot water, and the sodium fluoride separately, then they are mixed, brought up to 4 gallons, and the sulphur is then added. Birds are dipped one by one, and the solution worked well into the feathers so that it reaches the skin.

(e) **Poultry Lice.** Different species of lice may occur on fowls, and other species attack turkeys, ducks and geese. Lice do not suck blood, but live on feathers and the scales of the skin. They are not able to live for more than a few days off a bird.

Lice irritate the birds, which scratch and peck at their feathers, and make more use of dust baths. In severe attacks the comb may go black, the wings droop, and the feathers are ruffled. The growth of young chicks is retarded and they may even die, while hens drop

in egg production. Ducks and geese are not much affected by their lice as a rule.

On examination of affected birds, long, greyish-yellow lice are seen running on the skin when the feathers are opened suddenly, or lice may be found on the shaft of the feathers. Lice eggs or nits are found attached to feathers, especially below the vent in the case of common body louse.

The eggs hatch in from ten days to three weeks, depending largely on the temperature. When the young louse hatches it is similar in shape but smaller than the adult louse. It matures in two to four weeks. Lice multiply very quickly, especially during the summer, and live for several months.

Prevention. Where there are adequate pens, the rearing of young stock apart from old birds, and keeping them separate always, should keep the flock free of lice. Lice spread by contact with infected birds.

When the birds run free or cannot always be kept separate, all birds should be treated, making sure that none are missed. This treatment should be done in winter and repeated a month later.

All stock introduced should be treated before they are put with the flock.

Treatment. Sodium fluoride or D.D.T. powder are both very successful in ridding the birds of lice. They both remain in the feathers for some time and kill the lice which hatch out later, so that only one treatment is necessary. A pinch of the powder is placed in the head, on the back, below each wing, and under the vent, and rubbed in. One pound will treat 100 birds. The eyes and nose of the operator should be protected when sodium fluoride is used.

Forty per cent. nicotine sulphate can also be used to control lice; 8 ozs. per 100 feet of perches is required, and is painted on top of the perches with a fine brush just before the birds go to roost. The night should be hot and still, so that the nicotine fumes will rise and kill the lice. All birds must be made to perch on the treated perches. The eggs of the lice are not affected, so that two further treatments at intervals of ten days are necessary. This system is more expensive, but obviates the handling of the individual birds.

(f) **Fleas.** Fleas are all blood suckers and usually attack a variety of hosts. The most common flea infesting poultry in South Africa is the Chigoe, or sticktight flea, which also attacks dogs, cats, rats and other small animals. In the adult stage it is a permanent parasite and is found attached round the eyes, on the face and combs of fowls. It is more prevalent on sandy soil. Other fleas may also attack poultry.

The poultryman will usually discover the presence of fleas more quickly than any other parasite, as he is also attacked.

Eggs of fleas are deposited on the floors of the fowl houses, in nest boxes, or on the ground, especially in dry places where there is an accumulation of dirt. The eggs hatch in a few days, a pearly-white worm-like larva emerging. This feeds on organic matter in

the dirt and then pupates after a week. The pupa stage lasts a few days, and the adult flea emerges, and attacks the fowl. In summer the life cycle may take two weeks, but in winter up to four weeks.

Prevention. The poultry house and run should be kept as clean as possible. Dogs and cats should be kept away from poultry, and rats and mice exterminated. It is very difficult to prevent fleas unless the poultry houses have concrete floors.

Treatment. The chigoe fleas attached to the bird can be killed by smearing the infected parts with a mixture of lard and sulphur, in 1 part paraffin to 20 pars olive oil.

The floor of the house should be cleaned thoroughly, and D.D.T. powder should be dusted lightly in the house, especially in corners and nest boxes, and on any other suspected breeding places.

In Queensland it has been found that complete immersion of the birds in a 2 per cent. D.D.T. water dispersible dip prevented re-infestation of the birds for at least 16 weeks.

(g) **Bed Bugs.** These may occasionally attack poultry, and if present are found mostly round the perches and in the nest boxes.

Treatment. The D.D.T. treatment as used for red mites has proved successful in exterminating bed bugs.

(h) **Mosquitoes.** These, in addition to irritating the birds at night, are mainly responsible for transmitting chicken pox to fowls.

Where possible their breeding places should be treated, and the spraying of the walls of the poultry house with D.D.T. will help in killing mosquitoes which stay over in the house.

Most poultry parasites do not cause symptoms to show up in the birds until infestation is severe, thus the poultryman must make regular examinations for their presence. Apart from the direct loss they cause and the diseases which they may transmit, parasites lower the vitality of the flock and make them much more susceptible to other diseases, especially colds and roup.

The better the feeding, the housing, and the general management of a flock, the more resistant will the birds be to severe infestation. Parasites will multiply faster in a flock which is low in vitality, fed unbalanced rations, or housed under poor conditions. The poultryman who keeps his plant clean, and who makes a practice of isolating and treating all introduced birds before he puts them with his own flock, will have very little trouble from parasites.

The Use of Compost for Flue Cured Tobacco

PART I.—FIELD TRIALS.

By A. A. MOFFETT, Tobacco Research Station, Trelawney.

Introduction. The question as to whether applications of compost to flue-cured tobacco produce a worth while beneficial effect has given rise to considerable discussion and controversy in this country. Reports from growers have been contradictory, some claiming to have had striking increases in yield and quality, while others say they have had no noticeable effects.

Compost on tobacco lands has been tested on this Station for a number of years, and the results, while being far from negative, have been variable. The variable results and contradictory reports suggested two possibilities:—Firstly, that some types of compost have a better effect than others, and secondly, that compost only shows its full effect depending upon certain soil or weather conditions.

In order to test these possibilities a number of growers, who have had good results from compost, were approached for a sufficient quantity to carry out comparative trials. Unfortunately, the amount of compost available and other considerations did not permit more than one experiment, and tests had to be confined to one soil. It was decided to make the tests on "reverted" land, i.e., land which had previously grown tobacco for two years and then had returned to natural grasses for four years. It is on this type of soil that the yield and quality of tobacco tend to be poor, while claims for beneficial effects from compost have practically all referred to "old" land.

Although compost has been tested on reverted land for one year only on this station, the results were so striking, and so fully substantiated the claims of many growers, it was felt that they should be published for general information.

The effects of compost on tobacco were checked, as far as possible by a chemical analysis of the composts, soils and leaf. The results from this side of the investigation are discussed in Part II of this paper.

Results from Past Experiments. Before going on to describe the tests made during 1946/47, the results of the past seasons are briefly summarised below for reference.

1939-40. Compost made from sunn hemp stalks applied at the rate of 4 to 8 tons per acre to land carrying its fourth successive

Figure 1

Composts used in the trial

Plate 1.—Compost 1 (Trelawney). Well broken down except for tobacco stumps.

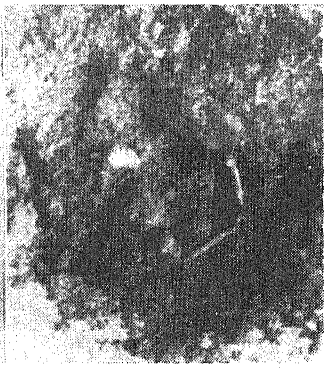

Plate 2.—Compost 2. Well broken down, with a high proportion of organic matter.

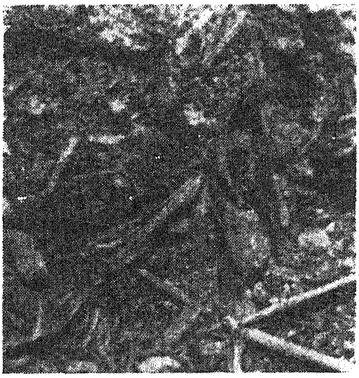

Plate 3.—Compost 4. Partially broken down, but rich in organic matter, potash and phosphate.

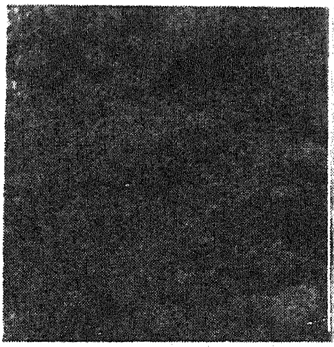

Plate 4.—Compost 6. Well broken down. Low in organic matter.

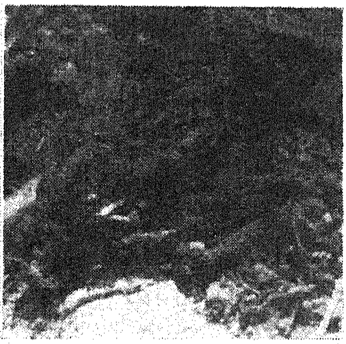

Plate 5.—Compost 7 (Trelawney). Partially broken down.

Figure 2

Plant grown on 3 lbs. of compost and 7 lbs. of sand. with white stick 1 ft. long

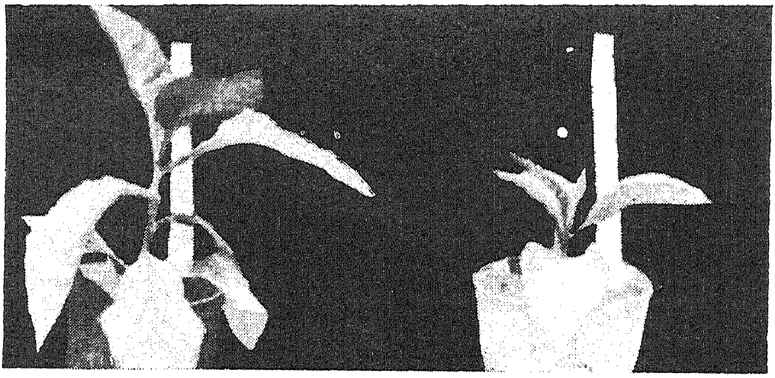

Plate 1.—Compost 1 plant.

Plate 2.—Compost 2 plant. Very poor growth.

Plate 3.—Compost 4 plant. Most vigorous growth.

Plate 4.—Compost 6 plant.

Plate 5.—Compost 7 plant.

crop of tobacco. Each level of compost gave significantly higher yields than no compost, the increases being:—

4 tons per acre	22% increase in yield
8 tons per acre	37% increase in yield

1940-41. Two composts applied at the rates of 3½ to 7 tons per acre were applied to land carrying its second crop of tobacco but which had been opened and ploughed over year before the first crop. The composts were made (A) from tobacco stalks and (B) from mixed wastes, including sunn hemp. Both gave significantly higher yields than no compost, the increases being:—

Compost A.—

3½ tons per acre	12½% increase in yield
7 tons per acre	12 % increase in yield

Compost B.—

3½ tons per acre	15 % increase in yield
7 tons per acre	22 % increase in yield

1941-42. Compost from mixed wastes applied at the rate of 4 tons per acre to land carrying its third successive crop of tobacco gave a significant increase in yield of 18% compared with no compost.

1942-43. Compost applied to new land at the rate of 4 tons per acre gave no increase in yield or quality.

1943-44. Compost from mixed wastes applied at the rate of 4 to 8 tons per acre to land carrying its second crop of tobacco opened and ploughed late in the dry season preceding the first crop gave no increase in yield, but a significant increase in quality occurred with each level of compost.

1944-45. Compost from mixed wastes applied at the rate of 4 to 8 tons per acre to land carrying its second crop of tobacco but opened and ploughed on year previously to the first crop, gave no increase in yield or quality.

1945-46. Two composts were used. (A) from mixed wastes made during the rains and (B) made exclusively from sunn hemp stalks during the dry season. Both composts were applied to land carrying its second crop of tobacco, ploughed at the end of the rains preceding the first crop. The results were:—

Compost A.—

5 tons per acre	4.4% increase in yield
10 tons per acre	12 % increase in yield

These differences were not significantly better than no compost.

Compost B.—

4 tons per acre	7% increase in yield
8 tons per acre	18% increase in yield

The increase brought about by 8 tons per acre was significantly better than no compost, and the increase due to 4 tons almost so.

In four out of six years compost gave increased yields varying from 7% to 35%, while in a fifth season, although there was no increase in yield, there was a significant increase in quality.

Compost Tests, Season 1946-47. Five different composts were used, three being obtained from the growers and two made on the Station. The following is a brief description of the materials from which the composts were made and method of making:—

No. 1: Kraal Compost (Station). Made from mixed wastes, including tobacco stalks, grass and maize trash, trampled during the rains by working oxen. The compost was turned twice towards the end of the rains. No ash or other material was added. This compost was well broken down, little undecomposed matter remaining. (Plate 1, Fig. 1.)

No. 2: Farm Compost. The following description of the making was given: Approximately 100 wagon loads of grass scattered in the kraal at different periods commencing May, 1946. During June and July 5,000 lbs. scrap tobacco was added, and in August ash from 200 cords of wood was spread over the whole area. Towards the end of August all the material was placed in a heap 4 to 5 ft. high and water applied until the moisture penetrated to the bottom. The compost was turned three times at intervals of about three weeks, the temperature at the last turning being very high. The compost was very well broken down, very little decomposed matter remaining. (Plate 1, Fig. 2.)

No. 4: Farm Compost. Prepared by penning steers in May. The feeding was whole maize silage, bean hay, salt and veld hay. The bedding was veld hay. No mealie meal or concentrate was fed. No earth was added to the compost, but a liberal dressing of wood ash was supplied. No details of watering or turning were given, but presumably these operations were carried out in the usual manner.

The compost was not very well broken down, and there was a considerable amount of undecomposed matter. (Plate 1, Fig. 3.)

No. 6: Farm Compost. Made during the dry season from veld grass which had been used as bedding for dairy cows, calves and pigs. Soil and ash were added in the usual proportions. The heap was turned four times, taking about three months to reach maturity. This compost was well broken down, little undecomposed matter remaining. (Plate 1, Fig. 4.)

No. 7: Sunn Hemp Compost (Station). This compost was made during the dry season from sunn hemp stalks only. The stalks were not trampled by cattle, but manure was collected and mixed with

the sunn hemp, together with wood ash. The heap was turned three times and heated very well. At the time of applying the compost to the land there was still a considerable amount of undecomposed organic matter. (Plate 1, Fig. 5.)

Viable Weed Seeds in Compost. The composts were tested for viable weed seeds by spreading a weighed amount of each compost in a thin layer over sterile sand and watering. The number of weed seeds germinating was then counted. In all cases the great majority of weeds consisted of rapoko grass (*Eleusine indica*). The two station composts made from the manure of cattle grazed over old tobacco lands during the seeding time for rapoko grass had the highest percentage of viable seed. The high percentage of viable seeds in the station composts may be due in part to the small size of the heaps, giving a relatively high proportion of surface to volume. The following are the seed counts per ton compost.

TABLE 1.

Viable Weed Seeds in Thousands per Ton Compost.

	Compost				
	1	2	4	6	7
Viable weed seeds (in thousands)	146	45	52	75	134

In spite of the fact that some of the composts are known to have headed extremely well in the heap, a very considerable number of weed seeds remain viable. While the introduction of weed seeds on this scale may not be of major importance in the fields, it is probable that it would cause considerable difficulties if applied to seed-beds.

Experimental Details. The land chosen for the experiment was a light sand which had been under natural fallow for four years. The land was ploughed in early November and the composts were applied on 25th November, being broadcast and dug under with hoes.

The moisture content of all the composts was determined, and all applications brought down to a common level which worked out at the rate of 4 tons per acre dry compost.

Fertiliser was applied at the rate of 300 lbs. per acre of a P10-N6-K8 mixture, 150 lbs. per acre being applied on 2nd December, 1946, and a further 150 lbs. per acre on 23rd January, 1947. Owing to the difficult season, planting did not take place until 27th December. The variety used was Bonanza, and the spacing 3 ft. x 3 ft.

The rainfall during the season was light and very erratic, the monthly totals being as follows:—

December, 4.55; January, 5.34; February, 3.85; March, 3.29; April, 0.99.

Apart from two dry periods which caused considerable wilting and damage to the leaf, growth conditions were, on the whole, good.

The following were the treatments tested:—

1. Kraal compost (Station) + 300 lbs. per acre P10 N6 K8 mixture.
2. Farm compost No. 2 + 300 lbs. per acre P10, N6 K8 mixture.
3. No compost + 300 lbs. per acre P10 N6 K8 mixture.
4. Farm compost No. 4 + 300 lbs. per acre P10 N6 K8 mixture.
5. Sunn hemp compost (Station) + No fertiliser.
6. Farm compost No. 6 + 300 lbs. per acre P10 N6 K8 mixture.
7. Sunn hemp compost (Station) + 300 lbs. per acre P10 N6 K8 mixture.

The experimental lay-out was a randomised block design with five replications of each treatment.

Field Observations. Fourteen days after planting differences between treatments were observed. The compost only treatment (No. 5) was clearly distinguishable in each replication by its failure to show any signs of growth or colouring of the leaf. All the other compost treatments could be distinguished from the non-compost (No. 3) by their more vigorous growth and darker leaf colour. Amongst the compost treatments, Nos. 4 and 6 had made the best growth, followed by Nos. 7 and 1, but No. 2 was not as good as the others.

Five weeks after planting compost only No. 5 had made very little growth compared with the other treatments, but the leaves had darkened and the plants were beginning to grow. All the other composted treatments had made considerably better growth than the non-composted (No. 3). At this stage there was little to choose between Nos. 1, 4, 5 and 7, but No. 2 still lagged behind. At eight weeks the compost only treatment was making considerable growth, but was still markedly poorer than the other treatments. All the other composted treatments were very obviously better than the non-composted, and No. 2 still remained the worst of the composts.

The plants were all topped at the same stage, that is, when a single flower had opened. All were topped to the same height, 2 leaves below the topmost sucker being taken off. Leaf counts made after topping showed that there was little variation between plots, and that compost had not altered the leaf number. Even in the poorly grown No. 5 treatment the leaf number was almost identical with the better treatments. Stand counts were also made, and here again little variation occurred between treatments.

An examination of the treatments just before reaping showed that the compost treatments, with the exception of No. 5, had produced longer and larger leaf than the non-composted. The leaf size was better maintained to the top of the plant, and in spite of increased size and better growth generally, the leaf was not so dark green as that of the non-composted treatment.

Results on Basis of Yield and Quality. The results of the trial on the basis yield, price and quality are summarised in Table 1. Table 1 gives the yield per acre, average price and cash return per acre on the basic prices used in the Trelawney Annual Reports.

TABLE 1.

Yields, Basic Prices, and Values from Compost Trial. All Treatments.

Treatment	Stand in field	Yield: lbs. per acre	Yield: % of mean	Price: Pence per lb.	Price: % of mean	Value: £ per acre	Value: % of mean
Kraal (No. 1)	92	1,304	115.30	8.61	102.38	46/16/-	117.59
Farm (No. 2)	93	1,110	98.14	8.62	102.50	40/ 0/-	100.50
No compost (No. 3)	93	1,006	88.95	8.26	98.23	34/14/-	87.19
Farm (No. 4)	93	1,273	112.55	8.64	102.73	45/16/-	115.07
No fertiliser (No. 5)	91	752	66.50	7.91	94.05	24/16/-	62.31
Farm (No. 6)	94	1,259	111.32	8.34	99.17	43/14/-	109.80
Sunn hemp (No. 7)	93	1,212	107.16	8.48	100.83	42/14/-	107.29

The "Z" test was significant at both 1% and 5% points for yields price value.

TABLE 2.

Means, Standard Errors and Significant Differences for All Treatments.

	Yield	Price	Value
Mean of all treatments	1,131 lbs.	8.41d.	£39 16 0
Standard error	3.37%	1.68%	3.77%
Significant difference, 5% point	111 lbs.	0.41d.	£4 8 0
Significant difference, 1% point	150 lbs.	0.56d.	—
Sig. diff. % of mean 5% point	9.81%	4.87%	11.05%
Sig. diff. % of mean 1% point	15.14%	6.66%	—

Summary of Significant Differences at 5% Point.

Yield—

All other treatments better than 5.

1, 4, 6 and 7 better than 3.

1, 4 and 6 better than 2.

Price—

All other treatments better than 5.

Value—

All other treatments better than 5.
1, 2, 4, 6 and 7 better than 5.
1 and 4 better than 2.

It will be noticed that compost No. 2 was not significantly better than no compost, although almost so, while in value compost No. 1 was almost better than compost No. 7.

The results were analysed again, leaving treatment No. 5 out of the Analysis of Variance, as this treatment was obviously poorer than the others. The omission of treatment No. 5 reduced the error of the experiment, and the following standard errors and significant differences were then obtained.

TABLE 3.

Means, Standard Errors and Significant Differences, omitting Treatment No. 5.

	Yield	Price	Value
Mean of all treatments	1,194 lbs.	8.49d.	£42 6 0
Standard error	2.65%	1.66%	2.91%
Significant difference, 5% point	93 lbs.	—	£3 12 0
Significant difference, 1% point	127 lbs.	—	£4 18 0
Sig. diff. % of mean 5% point	7.83%	—	8.54%
Sig. diff. % of mean 1% point	10.68%	—	11.66%

Summary of Significant Differences at 5% Point.

Yield—

All treatments better than 3.

1, 4, 6 and 7 better than 2.

1 almost better than 7.

Value—

All other treatments better than 3.

1, 4 and 6 better than 2.

a better than 7.

The greater accuracy of the experiment has now shown that all compost plus fertiliser treatments are better than fertiliser only, that No. 7 has out-yielded No. 2, and that No. 1 is almost better than No. 7.

Results on Ruling Market Values. The results above, apart from the yields, are given on basic prices, so in order to get a

clearer picture of the effect of compost under present conditions, the prices and values of the treatments under prevailing market conditions tabulated.

TABLE 4.

Prices Obtained on Auction Floors and Values from Compost Treatments.

Treatment	1	2	3	4	5	6	7
Average market price (pence)	39.00	39.33	37.60	39.86	36.85	38.64	39.60
Cash return per acre (£)	212	182	158	211	116	203	200

While these figures show clearly the beneficial effect of compost in order to give some idea of the type of crop produced, the yields from various treatments have been split up into the percentage of the Tobacco Marketing Board's grades of curing in each treatment.

TABLE 5.

Percentage of Tobacco Marketing Board's Grades Occurring in each Treatment.

T.M.B. Grade	Market Price (pence)	Percentage Grades in Treatments 1	2	3	4	5	6	7
X1L	48	3.62	5.50	2.71	5.87	0.58	3.52	3.41
X2L	43	3.03	4.21	3.58	4.10	2.48	4.60	4.04
X4L	32	1.86	1.63	3.04	2.35	1.53	1.89	2.50
X20	43	2.66	4.12	3.91	3.58	1.82	4.04	3.50
L1L	48	1.35	1.48	0.38	1.36	0.29	2.96	1.64
L20	44	27.01	25.14	25.28	27.44	23.33	25.48	28.03
L30	43	15.67	11.95	12.94	14.29	13.24	13.71	16.06
L40	27	5.35	5.70	9.25	4.45	9.93	6.49	3.50
L2S	42	0.92	3.02	2.66	1.79	5.92	1.68	2.18
L4S	24	2.40	1.24	2.99	0.52	2.34	1.03	1.73
L2G	40	11.59	14.52	12.88	11.09	16.38	12.25	12.19
L4G	20	1.14	0.94	2.30	3.01	1.24	0.94	1.41
L1R	42	7.88	5.85	4.24	7.03	2.93	4.72	7.78
L3R	32	12.18	10.66	11.04	11.23	8.78	9.67	8.01
L4D	21	1.18	1.63	0.87	0.39	5.56	4.13	1.86
C2L	46	0.38	0.69	0.43	0.70	0.72	0.65	0.45
N3	3	1.77	1.68	1.19	1.92	2.41	2.23	1.46

Discussion. Two important facts emerge from this experiment, firstly, that compost on "reverted" land has had a striking beneficial effect on tobacco under the conditions prevailing last season, and secondly, that the composts vary very considerably among themselves as regards their effectiveness.

No. 2 compost, which gave the poorest return, was not by any means the lowest in nitrogen, but the carbon nitrogen ratio (22) was wider than any of the other composts. This compost actually rendered unavailable nitrogen from the soil and fertiliser, that is, the total nitrogen in the crop from No. 2 compost plus fertiliser was less than the total nitrogen in the crop from fertiliser only. The beneficial effect of this compost was not, therefore, due to the supply of additional nitrogen, but there is chemical evidence (Part 2) to show that a considerable part of the increased yield, compared with no compost, was due to the additional phosphate. It has been shown on this station (Trelawney Annual Reports) that there is an interaction between phosphate and nitrogen, and that the higher levels of nitrogen can only show their full effect in the presence of adequate phosphate. It has also been shown that this interaction is of greater importance in a dry season when the losses of nitrogen by leaching are at a minimum. The non-composted treatment received 300 lbs. per acre of P10-N6-K8 mixture, or 30 lbs. per acre P_2O_5, while the composted treatments received this amount plus the phosphate supplied by the compost. As last season was the driest recorded on the station and leaching at a minimum, 30 lbs. per acre phosphate was probably inadequate to balance the nitrogen. In a wet season, when the supply of phosphate is of lesser importance, it is possible that No. 2 compost would have little or no beneficial effect.

While in the season under review the additional phosphate supplied by compost appeared to be a major factor in increasing yield, other factors such as effect on soil structure, water holding capacity and stimulation of the soil flora may have played this part either directly or, indirectly, by making the phosphate more available for plant assimilation.

The failure of sunn hemp compost, No. 7, to give results equally as good as some of the other composts is more difficult to understand. This compost had a fairly good nitrogen content (1.12 per cent.) and the carbon/nitrogen ratio of 16 was lower than No. 4, which gave good results. The pH was, however, lower than the better composts, and may have affected the availability of phosphate. There is, however, one other point on which No. 7 differs from the other composts, viz., the sunn hemp was not trampled in a cattle kraal, but dried manure was collected and added to the heap. It is possible that the resulting compost was

lacking in plant stimulants or heteroauxins, as no urine was incorporated in the heap and it is in the urine that these stimulants mainly occur.

It is evident that the varying reports about compost are due, to some extent at least, to the quality of the product used, and it is important to check any method of making compost by a chemical analysis until a standardised formula is reached, which is likely to yield a fairly consistent good type of compost.

An examination of the results of the previous compost experiments on the Station suggests, however, that the variable results are not due to differences in composts alone. Although no conclusive evidence can be deduced, there is a definite trend showing that the effect of compost is directly proportional to the weathering of the soil. On new land there was no indication of any increase in yield or quality. On second year land ploughed during the dry season preceding the first year's tobacco, there was no effect on yield, but some on quality. On second year land ploughed before or during the rains preceding the first crop of tobacco the effect becomes more marked and is similar to that on land carrying its third successive crop, while on fourth year land the results become more striking still. "Reverted" or "old" land is likely to be deficient in humus, since once the soil is disturbed in this country and the humus is destroyed rapidly, and this process will continue presumably for some time after the land has returned to fallow, before the slow process of natural restoration commenced. It is probable, therefore, that provided a good type of compost is used, that a consistent beneficial effect will be obtained from its use on old lands.

Nothing has been said so far about the effect of compost on quality. On an experimental scale it is extremely difficult to evaluate the finer points of quality. Although the compost treatments on the whole (excluding 5) gave a higher average price than non-compost, this difference did not reach the level of statistical significance. An examination of the leaf during grading showed that, on the whole, leaf from the composted plots was more oily and elastic, and could generally be considered to be of better quality than leaf from the non-composted treatment. This impression was confirmed by chemical analysis which showed that the composted leaf was higher in sugars than the non-composted.

When the average prices for the treatments were worked out on the present market rates, the composted treatments showed an average price up to two pence a pound higher than the non-composted. It was not possible to analyse these differences statistically, but doubtless to many growers an increase to two pence per pound selling price will constitute as good a criterion of improved quality as any statistical analysis.

Acknowledgment. The farm composts used were kindly supplied by Messrs. R. Fischer, Headlands, R. B. Harland, Rusape, and L. C. Ziehl, Rusape

TABLE 1.—CHEMICAL ANANLYSES OF COMPOSTS.

Compost	pH as received	% loss on drying at 100° C.	% of oven dry material											C : N ratio direct	C : N ratio estimated from ignition loss	Water holding capacity %	Remarks
			% loss on ignition	% acid soluble ash	% insoluble ash	% Potash	% lime	% magnesia	% iron oxide (FeO)	% P_2O_5	% nitrogen N.	% ammonia	% organic carbon. C.				
Compost 1	8.3	31.6	20.6	5.7	73.7	0.69	1.33	0.05	0.2	0.44	1.09	0.009	12.1	11.1	11.0	125	Well broken down
Compost 2	7.2	35.7	41.7	6.8	51.3	0.61	0.92	0.02	0.2	0.40	1.05	0.049	23.9	21.8	23.0	191	Well broken down
Compost 4	8.6	37.0	42.6	15.9	38.5	2.14	4.97	0.15	0.4	1.15	1.38	0.042	22.7	16.5	17.9	146	
Compost 6	8.5	29.0	20.8	11.7	67.5	1.06	1.69	0.02	0.5	0.64	0.87	0.028	12.3	14.1	13.9	108	
Compost 7	7.3	41.4	34.0	5.4	60.6	0.69	1.25	0.025	0.25	0.64	1.12	0.015	17.6	15.7	17.5	140	
Trelawney compost, 1940 (sunn hemp)		48.2	18.8	11.1		0.67	4.00			0.74	0.65		9.0	13.8	16.8		
Trelawney compost, 1940 from Mr. Faed)		35.0	20.3	6.0		0.35	1.20			0.63	0.82		10.3	12.6	14.4		
Trelawney compost, 1941 (mixed wastes)			25.5	6.4	67.6	0.23	1.73			0.51	1.06				13.5		
Trelawney compost, 1941 (tobacco wastes)			22.6	11.2	65.8	0.50	3.90			0.67	0.91				12.9		
Trelawney compost, 1945			18.9								0.82				13.4		
Trelawney compost, 1945			19.7								0.83				13.8		
Average Rhodesian compost analysis			19.1			0.77	2.19			0.44	0.61				20.3		

PART II.—CHEMICAL EFFECTS.

By J. W. THOMPSON, Ph.D., B.Sc.

Chemical Analysis of the Composts. The chemical analysis of the composts used in the experiment are given in Table 1. For comparison the analysis of composts previously used at Trelawney are included, together with average values for 17 Rhodesian composts analysed at the Government Chemical Laboratory, Salisbury. The 17 samples differed widely between themselves, illustrating the variability of compost.

It will be seen that the composts used in the experiment this year were representative of several types. Number 6 was very similar in organic matter, loss on ignition, and nitrogen content to the composts previously used at Trelawney, which, on the whole, have varied very little from year to year. The Trelawney composts were in turn a little better in nitrogen content than the average Rhodesian product. No. 1 was similar to No. 6, but was somewhat higher in nitrogen content. No. 2 was very high in organic matter, but the proportion of carbon to nitrogen was so high that very little of the nitrogen was available. This compost was of interest, as the well broken down organic matter would benefit the soil structure without adding to the nitrogen supply. The low nitrogen content of this sample was probably due to the lack of nitrogen in the grass from which it was made, or to leaching, or a combination of both. It is possible to lose nitrogen by adding too much ash and making the compost heap too alkaline. Alkalinity was not the cause in this case, as the compost was less alkaline than all the others (i.e., the pH value was lowest).

No. 4 had a good supply of organic matter and nitrogen, although the effectiveness of the nitrogen was reduced by the relatively high carbon-nitrogen ratio. No. 7 had a fairly good organic matter content. The nitrogen content and the carbon-nitrogen ratio were somewhat above average, and these properties tend to cancel each other, so that the nitrogen supply will not be far from average.

No. 4 compost was produced from penned cattle and was outstandingly high in potash, calcium and phosphate. Like No. 7 it was not well broken down. (See Fig. 1.)

The magnesium content was so low in all cases that the effect on the magnesium supply to the plants should be negligible.

One point of academic interest was that the percentage of nitrogen present as ammonia decreased as the carbon-nitrogen ratio decreased. Also, as stated previously, if the heap is too alkaline, nitrogen losses take place in the form of ammonia. As there is no relation between pH and ammonia content, it indicates ammonia losses are small.

The water holding capacity is expressed as the percentage increase in weight when dry compost is saturated and allowed to drain for a fixed time. Most of the fertiliser leaching in the lands takes place by capillary action bringing moisture and dissolved salts to the surface, from where they are washed away and lost.

(Annual Report, Tobacco Research Board, 1940.) The addition of organic matter would probably tend to prevent moisture and dissolved salts rising to the surface and the moisture holding capacity of the compost may be an important factor in a wet season.

TABLE 2.—WEIGHTS AND CHEMICAL ANANLYSES OF PLANTS GROWN ON COMPOST MIXED WITH SAND.

Compost	Mean weight of leaves (grams)	Mean weight of stem and roots (grams.)	Total grams	% nitrogen	Wt. of nitrogen per plant (grams)	% Potash	Wt. of potash per plant (grams)	% P_2O_5	Wt. of P_2O_5 (grams.)
1st Series									
1	17.0	11.1	28.1	.87	.245	2.49	.69	.92	.26
2	4.4	3.5	7.9	.85	.067	2.14	.17	1.04	.03
4	22.4	19.9	42.3	1.16	.49	2.70	1.14	.95	.40
6	19.1	11.7	30.8	.86	.27	2.70	.83	.71	.22
7	19.8	15.6	35.4	.95	.34	1.58	.55	1.12	.40
2nd Series									
1	9.9	10.2	20.1	.83	.17	3.20	.64	1.06	.21
2	3.5	2.9	6.4	.71	.05	3.92	.25	1.33	.08
4	16.6	17.5	34.1	.99	.34	4.37	1.48	.83	.28
6	9.6	13.0	19.6	.76	.15	3.55	.70	1.02	.20
7	13.6	7.6	21.2	1.07	.23	2.92	.62	1.27	.27

Plants Grown on Compost and Sand. As a further test in addition to the chemical analyses of the composts, tobacco plants were grown on a mixture of sand and compost, each plant growing in 7 lbs. of sand and 3 lbs. of compost.

Five plants were grown in separate pots for each compost and two separate groups of plants were grown, making 50 plants in all. The first lot were taken from the seed-beds and put in the pots on 28th November. Growth proceeded for 82 days, when the plants were dried and analysed, commencing 18th February. The second were put in pots on 18th January and grown for the same number of days, and taken out 10th April. The average weights and analyses are given in Table 2.

Typical plants from the first group are shown in Fig. 2, together with a white stick 1 ft. long. It will be seen that there were very great differences between the plants, No. 2 having a very poor growth, while No. 4 was outstanding.

Although the second lot of plants did not grow as well as the first, the relative sizes are the same in both cases. No. 2 compost produced the smallest plants with the lowest nitrogen content in each case, thus confirming the non-availability of the nitrogen.

No. 4 compost supplied most nitrogen, potash and phosphate in each case, confirming the superiority suggested by the chemical analysis. The figures indicate that No. 7 had more nitrogen and less potash than Nos. 1 and 6, which were about equal in both. Nitrogen was the main factor determining the size of the plants in the pots, but as shown later, phosphate was more important in the field, and no relation between yield increases and pot plant weights could be expected.

Soil Analysis. The figures for the NPK soil analysis were not very reproducible, and duplicate determinations of the same piece of soil did not produce the same results. This suggests that the rainfall was insufficient to disperse the fertiliser uniformly, and that small particles of undissolved fertiliser disturbed the analyses. However, there were indications that No. 4 compost was giving a greater amount of available phosphate than the remaining treatments. (Phosphate soluble in 1% citric acid.)

The effect on the pH of the soil was marked. All the composts raised the pH (i.e., rendering the soil less acid). No. 4 compost had the most marked effect, raising the pH from 5.68 to 6.46. No. 2 had the least effect, raising the pH by 0.16, the remaining composts producing intermediate effects. All the increases were statistically significant, except that of No. 2.

This effect of raising the pH would be expected to make the phosphate in the soil more available. The raising of the pH was not due to bacterial action in the soil, since dried, finely divided compost mixed with an equivalent amount of soil raises the pH in the laboratory in a few minutes by an amount equal to or greater than that observed in the field. The magnitude of the effect by the different composts was also relatively the same, No. 4 compost having the largest effect in the laboratory or on the land. The pH differences were therefore due to alkalinity in the compost at the time of application.

The fine organic matter in the soil was measured by chromic acid oxidation. Coarse organic matter retained in a 1 mm. sieve was also measured by loss of ignition and checked by grinding and estimating by chromic acid oxidation. Duplicate samples of each of the 35 plots were analysed and the whole procedure repeated, producing substantially the same results. Differences in organic matter due to soil variation over the land were over twice as large as the differences due to the additions to the organic matter by the composts. These soil variations were sufficiently large to make any differences in organic matter between the various treatments insignificant. Since yield differences were highly significant, the inference is that in this particular dry season the soil organic matter was not one of the major factors determining yield, however desirable the organic matter may be from other points of view.

Cured Leaf Analyses. The results of the analyses of the crop are given in Table 3. For the first five quantities, nitrogen, potash, phosphate, lime and ash, a separate sample from each of the 35 plots was analysed and the significant differences at the 5% point are given. The range of average values for six groups of samples from various sources in the country, taken in different seasons, is also given.

The remaining analyses were done on composite samples from the five plots of each treatment.

In Table IV the nitrogen, potash, phosphate and lime figures are presented as lbs. of substance in the leaf per acre. The differences between the amounts present in the fertiliser-only plots and the compost-and-fertiliser plots gives an estimate of the relative amounts contributed by the composts. The comparison of Tables 3 and 4 shows when the supply of a fertiliser component has been increased by the application of compost and whether this increase in supply has been accompanied by an increase in the percentage of the component in the leaf. It has been assumed that the crop was of uniform composition. This was not so, as the leaf varies in composition from top to bottom of the plant, but as the middle picking was analysed, the assumption is sufficiently accurate to give valid comparisons.

Discussion. The beneficial effect of compost on crops has been ascribed to some or all of the following effects:—

(1) Compost is a source of fertiliser elements.

(2) Compost makes the fertiliser elements in the soil more available to the crop.

(3) The organic matter has a beneficial effect on soil structure, reducing leaching of plant nutrient, giving better aeration, etc.

(4) Compost promotes the mycorrhizal association, whereby the feeding of the plant is facilitated.

(5) Compost is a source of heteroauxines, small traces of which in the soil stimulate root production.

(6) Compost may have a beneficial effect on the soil fauna and flora.

This season's work has been concerned mainly with the first three possibilities only. It is hoped to include work on all the above possibilities in the following season.

As stated previously, it is unlikely that the effect of compost was due to adding organic matter to the soil. Also, compost No. 2, which contained most decomposed organic matter, gave the smallest increase in yield. In a wetter season, aeration of the soil or fertiliser losses by leaching may be of critical importance, in which case the addition of organic matter might affect the yield.

The magnesia contents were all about average and well above the deficiency level (less than 0.25%). The proportion of magnesia in the compost was so low in most cases that no large effect could

be expected, and it is therefore unlikely that the yield increases due to compost are associated with the magnesia supply.

The aluminium content of a plant is usually very small, and the aluminium found is mainly due to contamination of the sample by soil. The aluminium contents found were low, indicating the samples were fairly free from dirt.

The presence of chloride and sulphate in the fertiliser (as potassium chloride and calcium sulphate in superphosphate) was reflected in the low chloride and sulphate content of the tobacco grown on compost only. Some of the chloride in the salt fed to the cattle producing compost No. 4 has obviously found its way into the tobacco, but not in sufficient quantity to have any effect.

The compost-only tobacco was low in potash, phosphate and lime, which probably accounts for the meagre yield. In a wet year nitrogen might have been added to the list of shortages. It was noticed that the compost-only tobacco grew much better this year than in previous years, and the improved growth may be associated with reduced leaching of nitrate.

The following chemical evidence strongly indicates that the increased yield brought about by compost in the particular season on the particular piece of land studied was primarily due to an increased supply of phosphate.

When tobacco is grown under conditions of moderate deficiency of a particular fertiliser component, the yield is limited by that component, and generally a lower percentage is found in the plant than would be found in a plant grown on an adequate supply.

When the plant is grown with a surplus of a particular component, a surplus is taken up by the plant and generally a relatively high percentage is found in the plant.

If the increase in yield due to compost is due to the compost relieving a deficiency of a particular element, it is likely that the percentage of that element found in the plant will be higher in the composted plots and relatively low in the non-composted plots.

Compost produced an increase in the percentage of phosphate in every case except No. 5, when fertiliser was omitted and the yield was least. The percentages of the other fertiliser elements were in most cases decreased by compost, indicating that they had been diluted by the increased growth, in spite of the extra amounts contributed by compost.

The major importance of phosphate in producing the increased yield is shown by these further points:—

(1) There is a highly significant positive correlation between yield and the percentage of phosphate in the leaf. (Correlation coefficient .541, significant at considerably less than the 1% point.) With all the other elements no such correlation was found.

(2) The correlation between the yield and the total amount of phosphate in the leaf is very close, but that for nitrogen is not so close.

(3) Only phosphate and lime percentages are markedly below average, but the lime percentages were decreased by compost while the phosphate percentages were increased.

(4) The tobacco from the composted plots contained up to 40% more phosphate than that from the fertiliser-only plots, and the yield increases were up to 30% greater. The increases in the other elements were all smaller. Further, the increase in yield brought about by a particular compost is very nearly proportional to the amount of phosphate supplied by the compost (Table 4). No such relation exists for the other elements.

The increase in supply of the other elements is likely to have produced some increase in yield—particularly the increase, in some cases, of the nitrogen supply, since it has been established by previous work at this station that, over a wide range of rates of fertiliser application, the increase in yield produced by increasing nitrogen and phosphate supply simultaneously is greater than the total yield increase produced by both alone. Thus, the increase in nitrogen supply produced by composts Nos. 1, 4, and 6 will have contributed to the yield, and the reduction in the supply of nitrogen will have partly accounted for the smallness of the increase in yield brought about by compost No. 2.

It seems, therefore, that the increased phosphate supply has increased growth and diluted the nitrogen in the plants. It has been shown previously in America (Reference 1) that an increased nitrogen content is accompanied by a decreased sugar content. With these samples, the same effect is observed, the correlation of sugar and nitrogen contents being very close. The phosphate supply only influences the sugar content indirectly, as the phosphate-sugar correlation is not nearly so close as that of nitrogen and sugar. Increase of percentage sugar is associated with an increase in quality (Reference 2), lack of sugar indicating lack of maturity and, in the more extreme cases, the green, rank tobacco associated with excess nitrogen.

In the case of cigarette tobaccos, the term body refers to the content of soft, semi-fluid constituents which contribute to the weight of leaf without influencing its thickness or density of structure, and a leaf is said to be deficient in body when it is of a dry, chaffy nature. (Reference 2.) The resin content is part of the semi-fluid constituents, but it is only one-quarter of the sugar content and perfectly dry tobacco is brittle, showing that oiliness is mainly due to water soluble constituents, the most important of which is some form of sugar. The sugar content is thus an important factor in determining the "oiliness" of tobacco.

It is possible that the increased phosphate supply is associated with the effect of compost on the pH of the soil. Phosphate is rendered unavailable in acid soils and compost decreased the acidity of the soil in the plots. The three composts, 1, 4, and 6, with the greatest effect on the phosphate availability, were the three with the high pH (8.3, 8.6 and 8.5 respectively), and the greatest effect on the soil acidity. The two composts with the least effect were 2 and 7, with pH at 7.2 and 7.3 respectively.

It has been suggested in previous reports (Tobacco Research Board's Annual Report, 1943) that the nitrogen and phosphate supplied to the plant must be balanced, and that adding nitrogen to a balanced supply will not increase the yield unless a corresponding amount of phosphate is added. As nitrate is very easily washed out of the soil and phosphate is not, it follows that the proportion of nitrate supplied must be increased in wet years, and that in very dry seasons a surplus of nitrate is probable. This explains the shortage of phosphate in this last season, and adds additional probability to the foregoing explanation.

It is also possible that in a wet season the factors influencing the nitrogen supply will be more important than those governing the phosphate.

Table 1 shows that the high carbon : nitrogen ratio of compost 2 actually decreased the amount of nitrogen available to the crop. The analyses of the Rhodesian composts analysed in the Government Laboratory, Salisbury, indicate an average C : N ratio of over 20, which shows that a large proportion of the samples analysed would be very poor suppliers of nitrogen for tobacco.

Conclusions. It is thus evident that compost modified considerably the chemical composition of the cured leaf and makes substantial contributions to the major fertiliser element requirements. These requirements will vary, but for this season and on the particular soil under discussion, the main effects of compost have been:—

(1) The phosphate supply has been increased, thereby increasing the yield. This is evident since—

(a) the phosphate percentages are low;

(b) the additional phosphate supplied by the compost has *increased* the percentage in the plant;

(c) there is a close correlation between yield increases and the increase in percentage phosphate found in the leaf;

(d) previous experience makes it likely that phosphate will be in short supply in a dry season.

(2) The increase in growth produced by the better phosphate supply has diluted the nitrogen in the plant and lowered the observed percentage of nitrogen.

(3) The decrease in nitrogen has brought about an increase in sugar content, which is associated with an increase in quality.

(4) The potash supply has been increased, which improvement is associated with cleaner leaf. In some cases the increased supply of potash could not compensate for the increased growth and the percentage of potash dropped.

It seems that the degree of breakdown of the compost is of secondary importance, provided the carbon : nitrogen ratio is at a

suitable level. The carbon : nitrogen ratio decreases as the compost matures, and the nearer the compost is to maturity, the more available is the nitrogen content unless nitrogen losses take place by leaching or excessive alkalinity.

From the analysis and appearance of the composts it is apparent that the methods of manufacture vary very widely. It is not yet possible to say which of these methods are most suitable for use with tobacco, but valuable indications have been found which, if followed up, should provide a sound basis for practical procedure.

The results also emphasise the importance of balancing the phosphate and nitrogen supply, which, in a dry season such as the last, means avoiding excess nitrogen.

References—

(1) Darkis, F. R., Dixon, L. F., Wolf, F. A. & Grus, P. M. Ind. Eng. Chem. 29 to 30. 1937.

(2) Darkis, F. R., Dixon, L. F., & Grus, P. M. Ind. Eng. Chem. 27, 1152-7. (1935.)

TABLE 3.—CHEMICAL ANALYSES OF 4TH PICKING TOBACCO (CURED LEAF).

	1	2	3	4	5	6	7	Significant Difference	Typical Leaf
Nitrogen	158	1.48	1.78	1.68	1.55	1.49	1.49	0.09	1.4 - 1.8
Potash (K_2O)	427	4.45	4.19	4.55	3.70	3.85	3.81	0.39	4.3 - 5.3
Phosphate (P_2O_5)	0.515	0.494	0.490	0.532	0.487	0.540	0.514	0.029	.70 - .90
Lime (CaO)	2.38	2.47	2.57	2.37	2.24	2.21	2.13	0.23	
Ash	13.26	12.88	14.55	14.24	12.28	11.84	12.02	1.10	
Sand + Silica (SiO_2)	2.1	2.3	2.4	2.0	2.4	1.4	1.8		
Al_2O_3 + Fe_2O_3	0.11	0.11	0.16	0.11	0.11	0.16	0.10		
Magnesia (MgO)	0.60	0.57	0.59	0.49	0.56	0.48	0.58		
Ether Extract	3.78	3.68	3.98	4.00	3.76	3.34	3.66		
Nicotine	1.69	1.48	1.45	1.42	1.74	1.74	1.71		
Chloride	.523	.502	.785	.828	.248	.685	.504		.27
Sulphate (SO_3)	0.88	0.86	1.00	0.80	0.64	0.86	0.86		
Reducing Sugars	16.2	16.4	14.10	15.6	15.5	16.1	17.0		

TABLE 4.—AMOUNTS OF FERTILISER COMPONENTS TAKEN UP BY THE CROP.

	1	2	3	4	5	6	7
Lbs. of nitrogen in leaf per acre	20.68	16.37	17.95	21.40	11.62	18.80	18.11
Nitrogen contributed by compost	2.73	−1.58		+3.45		0.85	0.16
Lbs. potash in leaf per acre	50.7	49.4	42.2	55.8	27.8	48.4	46.2
Potash contributed by compost	8.5	7.2		13.6		6.2	4.0
Lbs. phosphate in leaf per acre	67.2	54.7	49.3	67.7	37.3	68.9	62.3
Phosphate contributed by compost	17.9	5.4		18.4		19.6	13.0
Lbs. lime (CaO) in leaf per acre	31.1	27.4	25.8	30.2	17.3	27.8	25.8
CaO contributed by compost	5.3	1.6		4.4		2.0	0
Total yield (lbs. per acre)	1,304	1,110	1,006	1,273	752	1,259	1,212

Dark Fire-Cured Tobacco Culture in Southern Rhodesia

By D. D. BROWN, Chief Tobacco Officer.

The production of dark fire-cured tobacco in Southern Rhodesia is confined to the maize belt in the Mazoe District and to a few limited areas in several other districts where soil and climatic conditions have proved suitable.

Although the cultivation of this class of tobacco was first introduced here during the 1924-25 season it has not assumed any great proportions. From a small beginning in 1924 the acreage under dark fire-cured tobacco increased to 3,228 acres, yielding 2,000,000 lbs. in the year 1932. Since then the acreage has remained under the 2,000 mark and the yield has been less than 1,000,000 lbs. each year.

Many of the older established growers were forced out of production by the drop in values resulting from competition with native-grown fire-cured tobacco produced in neighbouring territories.

The reason for lack of expansion, therefore, is mainly a matter of economics and is not due to lack of suitable soil or to unfavourable climatic conditions.

Climatic Conditions. For the production of fire-cured tobacco of good quality, a moderate rainfall is required, and should be well distributed throughout the growing season; precipitation in gentle showers is more beneficial than heavy downpours. The rainfall should be light during the ripening and harvesting period.

During the transplanting season the most desirable weather conditions are dull, misty days with frequent showers of rain. As soon as the transplants are established in the field, sunshine is essential to accelerate growth. From the time the plants have taken root in the field right up to harvesting, a full measure of sunshine is needed also for the proper development of the leaf.

A rainfall of 25 to 30 inches is sufficient for the production of fire-cured tobacco, provided it is properly distributed. Generally, the average annual distribution in our tobacco-producing areas is fairly uniform, but if extreme weather conditions should prevail, a drought is preferable to an excessively wet season.

As the tobacco plant is very susceptible to injury by frost, the growing season must be sufficiently long to allow the crop to mature and be harvested before the first frost occurs. From the time they are transplanted in the field, the plants will generally reach maturity in from 90 to 120 days. The growing season should therefore be of at least four months' duration.

Soils. Land for the production of fire-cured tobacco must be carefully selected. The class of soil preferred is a friable clay loam of good inherent fertility and containing a high percentage of clay, silt and humus. Such soil may be derived from diorite, dolerite, schist or banded ironstone. Certain alluvial soils will also produce good crops of dark-fired tobacco. Another important factor to be considered in the selection of soil is drainage, for tobacco is one of the most easily drowned crops known. Low-lying land and vleis which become water-logged during the rains are unsuitable.

The character of the sub-soil has an important influence on the production and quality of the leaf on any type of land. If the sub-soil is impervious, the plants will, in certain seasons, suffer damage through the land becoming water-logged. Should the sub-soil, on the other hand, be too porous, the tobacco may suffer from drought in seasons of light rainfall. Soil underlain by an excessively porous sub-soil will also not be retentive of artificial fertilisers. The most common type of sub-soil found underlying the soils suitable for fire-cured tobacco is somewhat similar to the surface soil, except that the sub-soil contains a greater percentage of clay, is close-textured, stiffer, varies in colour and may either contain a mixture of gravel or be divided from the surface soil by a layer of coarse rubble.

If possible, the crop should not be planted on virgin soil, but preferably on soil which has been previously cropped. The field should be of what is commonly called good, live soil. Worn-out lands must be avoided, as they are not conducive to proper growth and development of the crop. The land should therefore be properly managed in order to maintain the physical condition and humus content of the soil as near the original state as possible.

Rotation of Crops. The proper management of the land demands the adoption of some suitable system of crop rotation. When the same crop is grown continuously on the same field, it naturally follows that the soil is not cropped to the best advantage and the incidence of plant diseases and insect pests is increased. Suitable rotation of crops is essential if the quality and yield of tobacco is to be maintained, and also for the prevention or control of the root-knot nematode (*Heterodera marioni*, Cornu), commonly known as tobacco eel-worm.

Variations in climatic conditions and soil requirements make it impossible to devise a single rotation suitable for general adoption throughout the dark fire-cured tobacco producing areas.

Experience has so far shown that good results follow when a legume crop immediately precedes the dark fire-cured tobacco. The increasing evidence of nematode in tobacco land has emphasised the need for the use of non-susceptible and resistant crops grown in rotation with tobacco.

The following rotations are suggested for the benefit of those who may be considering the introduction of crop rotations in their farming programme. Some modification may be required to render these proposed rotations more suitable for local conditions and

requirements. The continuance of any rotation schemes giving satisfactory results in present use is recommended until such time as some more suitable rotations may be established.

1. Three-course Rotation—
   1st year—Tobacco.
   2nd year—Maize.
   3rd year—Legume—ploughed under.
   Repeat.

2. Four-course Rotation—
   1st year—Tobacco.
   2nd year—Cotton.
   3rd year—Maize.
   4th year—Legume—ploughed under.
   Repeat.

3. Four-course Rotation—
   1st year—Tobacco.
   2nd year—Maize.
   3rd year—Legume—for hay, stubble ploughed under.
   4th year—Grass—for hay, stubble ploughed under.
   Repeat.

In each of the above examples it is assumed that the rotation has commenced with tobacco being planted in land which has been under cultivation for at least one season previously.

Owing to the serious incidence of tobacco nematode, it is advisable that the choice of legumes and other crops used in rotation with tobacco should be restricted to plants resistant to eel-worm attack.

Collins* gives the following short list of plants of economic importance known to be resistant to nematode infestation:—

Velvet Beans—Florida, Mauritius, Somerset.

Cowpeas—Monetta (almost invariably), Brabham and varieties of Victor and Iron.

Sunn hemp.

Maize.

Munga.

Oats.

Soya Beans—Laredo variety.

Wintersome.

Peanuts—Most varieties, including Valencia, Virginia Bunch, Masimbika and Jumbo.

Grasses—All species.

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*J. C. Collins, B.Sc.: "Notes on Tobacco Root-knot Nematode."—("Rhodesia Agricultural Journal," May, 1927.)

Note.—In addition to the foregoing, Jubilack No. 74 and Marbilee (red seeded) velvet beans are to be recommended. Florida and Mauritius velvet beans are not widely grown in this Colony and difficulty may be experienced in obtaining seed. Somerset, Jubilack and Marbilee are popular varieties and seed is available.

Of the groundnuts, Valencia and Virginia Bunch are available locally; Laredo variety soya bean is not available.

Amongst the plants commonly used in rotation with tobacco and stated to be hosts of tobacco root-knot nematode, are the following:

Beans—Kaffir (Vigna catjang) and garden.

Cotton.

Cowpea—Most varieties except those enumerated in list of resistant plants.

Potatoes.

Sunflower.

Dahl (*Cajanus indicus*) syn—Pigeon Pea and Nandora.

Note.—According to Jack† a local strain of cotton, 9L34, is very highly resistant to nematode attack. Supplies of this seed may be ordered through the Secretary, Cotton Research and Industry Board, P.O. Box 124, Gatooma.

The Pasture grasses, including Rhodes (*Chloris gayana*), Sabi grass (*Urochloa*), Buffel grass (*Panicum maximum*), Rhodesian Sudan (*Sorghum arundinaceum*) are to be recommended for a temporary grass ley. If an annual grass or crop is required for conversion into hay or silage, the following may be grown:—

Munga (*Pennisetum glaucum*, syn. *spicatum*), oats, S.E.S., Kherson or Kinvarra only, sorghums, rapoko (*Eleusine corocana*), teff (*Eragrostis abyssinica*), Annual Sudan (*Sorghum sudanense*), and "Crowsfoot" grass (*Dactyloctenium aegyptium*).

Detailed instructions concerning the establishment of improved pastures is published in the October, 1938, issue of the "Rhodesia Agricultural Journal" and reprinted as Bulletin No. 1084.

Preparation of the Land. For the proper development of the plants and the production of good quality tobacco, the plants should make rapid and continuous growth in the field. The tobacco fields should, therefore, be carefully selected and the land prepared thoroughly and brought into good tilth before the crop is transplanted.

In the case of land that has been planted with a legume or other crop for green manuring the soil preparatory to producing fire-cured tobacco, it is desirable that the green manure crop be ploughed under while the soil still contains sufficient moisture for the ready decomposition of vegetation and its conversion into humus. Soil thus treated is rendered more friable and retentive of moisture. After lying fallow during the winter months, the land

†R. W. Jack, F.E.S.: Report on Tobacco Research Board for 1944.

should be ploughed and cross-ploughed, and then harrowed with a heavy disc harrow, being finally reduced to a good tilth by means of drag harrows. Whenever possible, the final ploughing and harrowing should be made after the soil has been moistened by the early rains, since subsequent weeding and cultivation will be reduced to a minimum.

When farmyard manure or compost are being applied broadcast, this operation is carried out before the final ploughing. Broadcast applications of fertiliser, on the other hand, are made after the final ploughing and just before the last disc harrowing of the field. To complete the preparation of the land, especially the shallow soils, it is necessary to form parallel ridges across the field by means of a ridging plough. Ridging provides a greater depth of soil and consequently an increased area from which the plants may derive food. Soil drainage is also facilitated by ridges which should be made broad at the base and flattened off on top. Narrow ridges and hillocks are unsatisfactory and are not recommended. The spacing between the ridges should be from 3 feet 6 inches to 4 feet, according to the type of soil. If possible, the rows should be made to run east and west, so that the plants will receive the maximum amount of available sunlight. In this, however, the contour of the field will be the deciding factor. Ridges should be aligned diagonally across the slope of the field at an angle calculated to provide suitable drainage, and at the same time reduce the velocity of water flowing between each ridge after rainstorms. This will minimise soil erosion and leaching of fertiliser. On land where contour ridges have already been constructed for soil conservation purposes, the tobacco ridges should not be formed exactly parallel with the contour ridges, but should be placed at a slight angle, otherwise there may be some risk of water-logging during heavy rains.

Suitably constructed storm-water drains and contour banks should be provided, where necessary, for the protection of land and crops.

Around each field a strip of ground (say, 20 feet wide) kept free from weeds and grass will assist in keeping down insect pests.

When the margins of the fields are straight and suitable pathways are made at convenient intervals across the field, much time and damage is saved during all cultural operations.

Manurial Treatment. Until exhaustive experiments have been carried out in connection with the manurial treatment of each type of soil used for dark fire-cured tobacco, it will not be possible to furnish any categorical recommendations concerning fertiliser applications. Owing to the diversity of the types of soil, their varying degree of inherent fertility and lack of uniform treatment accorded in regard to tillage and cropping, it is only possible to deal with the fertilising of the crop in a general sense.

To secure good yields of desirable quality leaf, a complete fertiliser mixture containing the requisite percentage of phosphoric oxide, nitrogen and potash is needed. An understanding of how the various fertiliser constituents affect the growth, yield and quality of the crop is useful in determining the requirements for any set of soil conditions.

Phosphates hasten maturity, which is especially desirable in the production of dark fire-cured tobacco. The application of phosphates also increases the yield and improves the quality and colour of the leaf. An excessive quantity of phosphates in the fertiliser may result in a reduced yield by causing the leaf to ripen prematurely, especially on the lighter soils, which have a low nitrogen content, and particularly during seasons of drought.

Conversely, an insufficiency of phosphates, in relation to the supply of other nutrients, will cause delayed maturity and a reduction in yield. Where farmyard manure has been applied or a leguminous crop has been turned under, and there is an accumulation of nitrogenous matter, a liberal dressing of phosphates will prove beneficial.

The supply of available nitrogen has a marked influence over the growth, maturity, quality and yield of tobacco. An excess of nitrogen, especially if unsupported by a sufficiency of other fertiliser compounds, particularly phosphates, will induce rank growth and delayed maturity in the plants. The leaf will be coarse and susceptible to disease and will be dark coloured and lacking in quality when cured. An insufficiency of nitrogen results in the production of leaves lacking in size and body. Temporary shortages in available nitrogen sometimes occur during prolonged heavy rainfall, particularly on the lighter soils, and when the soil is cold and wet. Often such shortages disappear as the weather clears and the soil warms up. If the lack of nitrogen appears to be acute and the plants remain chlorotic, a top dressing of nitrogenous fertiliser should be applied to make good the shortage.

Potash improves the body, texture and colour of the leaf, aids leaf production and healthy development and increases the disease-resistance of the plant. Applied in the form of sulphate, nitrate or carbonate, potash improves the burning quality of tobacco. In the form of muriate, it impairs the combustibility of the cured leaf, and for this reason is not recommended as the sole source of potash in tobacco fertiliser mixtures. The effects of an excess of muriate on young plants are shown by thickening and brittleness of the leaf, curled edges and retarded growth. Muriate of potash, when used in moderation, tends to make a smoother leaf when the tobacco reaches maturity and also renders the cured leaf more retentive of moisture. It has been generally accepted, however, that while the yield, smoothness, texture and water-holding propensity of the leaf may be improved by the application of muriate of potash as a fertiliser, not more than one-third to one-half of the potash should be supplied in this form. A slight deficiency of available potash will cause the leaf tips to turn yellow and curl downwards. A serious shortage results in the yellow colouration spreading down the margins and between the veins of the leaf. These yellow areas turn brown later and fall away, leaving the rest of the leaf, which is brittle, dark geeen, rough and ragged in appearance. When cured, the leaf is coarse, brittle and lacking colour, body and elasticity.

The quantity of fertiliser mixture required per acre depends upon the inherent fertility of the soil and the proportions of the several elements of plant food contained in th

is false economy to apply light dressings, which give the plants a good start but do not provide sufficient plant nutrients to carry the crop to normal maturity with a full yield per acre. In such cases the leaf is undersized and lacking in body and quality. The yield is low.

Detrimental effects also arise from too liberal an application of fertiliser; in this case it induces a coarse, rank growth of leaf which is generally late in maturing, difficult to cure and of poor quality. Tobacco of this character is also more susceptible to attack by bacterial and fungal diseases when such are prevalent.

To produce satisfactory results, the rate of application of fertilisers must be correct, not only for each distinct type of soil, but should be adjusted to suit each individual field.

In Southern Rhodesia it has been found that applications of from 400 lbs. to 600 lbs. of high grade, complete tobacco fertiliser mixture per acre is an adequate dressing for dark fire-cured tobacco grown on soils recommended for this type of tobacco. The rate of application is modified in cases where the soil is much above or below the average standard of fertility. If lower grade mixtures are used, the rates of application per acre should be proportionately increased.

The nitrogen in mixtures used for fire-cured tobacco should be derived mainly from an organic source such as fish meal.

Fertiliser mixtures may be applied broadcast and harrowed into the soil before the field is planted, or they may be applied in a number of separate dressings. In the former case the full quantity of fertiliser is applied broadcast, preferably a few days before the crop is to be planted. The fertiliser is then thoroughly incorporated with the soil by harrowing before the field is ridged for the tobacco.

When fertiliser is to be applied in several separate dressings it is best that the first be made a week or two before the seedlings are transplanted. The second application is made after the plants are well established in the field, and this is followed by a further application several weeks later. The quantity of fertiliser required for each plant is measured out and applied in a line about four inches on either side, or in a circle around the plant and approximately four inches below the surface of the soil. The mixture should be thoroughly incorporated with the soil and care should be taken to prevent newly applied fertiliser coming into direct contact with the plants, otherwise the roots may be damaged and growth retarded.

The application of top dressings, especially during or after periods of heavy rain, is recommended in cases where the growth of the tobacco shows a tendency to decline or the plants are becoming stunted. A mixture made up of 80 lbs. complete fertiliser mixture, and 20 lbs. nitrate of soda, applied at the rate of 100 lbs. per acre, has proved to be a satisfactory top-dressing.

To obtain the maximum benefit from the use of artificial fertilisers, it is essential that the humus content of the soil be maintained. It has been found that the continued use of fertilisers rapidly depletes the remaining humus and renders the soil lifeless.

It is, therefore, necessary that the vitality of the soil be kept up by additional supplies of organic matter. Crop rotation and applications of farmyard manure or compost are the best means of maintaining the fertility of the land.

Farmyard manure, which should be old and well rotted, provides an excellent source of manurial treatment and should be applied broadcast, well in advance of the planting season, at the rate of about 8 tons per acre. A supplementary dressing of fertiliser is applied later.

Transplanting. Tobacco plants are raised from seed sown in seed-beds, and when the seedlings are about 6 inches in height they are ready for transplanting. Detailed information concerning the preparation and management of tobacco seed-beds is contained in the September-October, 1944, issue of the "Rhodesia Agricultural Journal" and reprinted as Bulletin No. 1278. It is therefore not necessary to discuss tobacco seed-beds here.

Tobacco of desirable quality is rarely produced from unsuitable plants, and the yield in most instances is disappointing. Seedlings which are less than 4 inches in height are sometimes used; these are too small and fail to make satisfactory growth unless the weather conditions are particularly favourable. A few hours of hot sunshine immediately after transplanting will either kill or seriously retard the growth of such small plants, while heavy rainstorms may cause them to become buried in the soil.

On the other hand, overgrown, tough and woody seedlings are often planted in order to complete the intended acreage. This class of seedling, as a rule, does not make satisfactory growth; the flower head develops while the plant is still small, and, after topping, the leaves remain under-sized and do not ripen normally. Maximum results can hardly be expected unless the tobacco is transplanted during the most favourable period of the season. The best time for transplanting fire-cured tobacco is generally from the beginning until the end of January, as in this case it is desirable that the tobacco should reach maturity after the heavy rains have ceased, and before the weather becomes too cold. In areas where the advent of the cold weather may be expected earlier than in the warmer parts of the Colony, the date of transplanting must be modified accordingly. A similar adjustment is required where the only available land is of a type which causes retarded maturity in the plants. If it is found to be absolutely necessary to plant out later than the period found to be most suitable, then that portion of the crop which is planted late should be given an additional application of quick-acting fertiliser to hasten the growth of the plants.

Before the plants are removed from the seed-beds, the latter should be thoroughly soaked with water, so that the seedlings may be pulled without damage. Diseased plants and those affected by eel-worm should be discarded and destroyed, to prevent further damage to the crop. The plants should be carefully packed in suitable receptacles and then transported to the field. Unnecessary exposure to direct rays of the sun should be avoided, otherwise the seedlings may be rendered useless through sunburn. When carting the plants from the seed-beds to the field, they should be protected by a hessian cover.

Transplanting is best done on dull, misty days with frequent showers of rain, and every opportunity offering for transplanting the crop during such weather should be fully utilised. It is seldom, however, that the whole crop can be transplanted under these ideal conditions; the planting operations are controlled by precipitation, often in the form of local showers, and also to a great extent by the degree of moisture in the soil itself. It is not advisable to transplant tobacco unless the soil contains sufficient moisture to prevent excessive wilting of the plants. Provided the soil is sufficiently moist, tobacco may be transplanted throughout the day, though the best time is during the afternoon, as then the plants are subjected to less intense heat immediately after transplanting.

The seedlings are transplanted at regular intervals, usually three feet, along the top of each ridge, or in the row when the field has not been ridged.

A short, pointed stick is used for making suitable holes in which to place the plants. These holes should be of a size which will readily accommodate the roots of the plant and yet leave no unnecessary air spaces. The plant is carefully inserted until the root crown is about three inches below the surface, and then the soil is firmly pressed down around it. The tap-root should on no account be bent up when the seedling is being transplanted; plants with a bent root seldom make satisfactory growth. Also, the heart of the plant should not be placed beneath the surface of the soil. In order to test the work of the planters, an occasional plant should be grasped by the tips of the larger leaves, and, if properly set in the ground, the plant will remain undisturbed, though the leaves may be torn by an upward pull.

Every endeavour should be made to secure an even and full stand of plants right from the time when the field is first planted. An imperfect stand is, for the most part, due to unfavourable weather conditions, insect pests, plant diseases, or bad workmanship. It should be borne in mind that a poor stand of plants seriously reduces the yield per acre. At the same time, plants growing round the margin of blank spaces in the field tend to produce leaf below the general average of the more closely spaced plants, thereby reducing the quality of the crop as a whole. Fresh plants should be transplanted to replace those which fail; such filling in should be accomplished as soon after the necessity arises as is possible. It is not advisable to fill in the blanks when the adjacent plants have attained a fair size, for tobacco plants transplanted under these conditions will be overshadowed and dwarfed by the bigger plants and fail to make satisfactory growth. Hence the importance of re-filling gaps as speedily as possible. The average stand of plants should be 80 per cent. or over, if profit is to result from the culture of tobacco. Experience has shown that all necessary re-filling of blanks should be completed within about a fortnight after the planting of the field. Any re-fills planted after this period are not likely to catch up with the rest of the crop, and consequently will be late in ripening. Many of the difficulties experienced during the harvesting and curing operations can be

traced to uneven growth of the crop in the field. These difficulties can, therefore, be minimised by the adoption of approved methods and the exercise of due care at the outset.

Cultivation. Cultivation should commence soon after the plants have become established in the field. The first cultivation should be shallow to avoid injuring or disturbing the plants. When the tobacco begins to grow properly, a thorough and deeper cultivation should be given in order to stir and aerate the soil. Subsequent cultivation must be shallow enough to avoid damage to the roots.

When the tobacco is grown on ridges, the field may be cultivated by the alternate use of the ordinary single-row cultivator and a wing-shovel plough; hand hoes should be used between the plants in the row. No set rule can be made except that, after the second cultivation, the crop is best cultivated only as often as is found necessary to keep the field free from weeds and grass. Cultivation with animal-drawn or mechanical implements should cease when the plants are so large that the leaves are liable to be damaged by the passage of implements between the rows. Any subsequest cultivation which may be necessary for weed control should be done by hand.

All cultivation should cease when the plants begin to flower. Disturbing the soil after this stage will tend to delay maturity and cause dust to adhere to the leaf. The crop should also not be cultivated when the soil is saturated by rain or while the tobacco is wet. Cultivation under such conditions is detrimental to the soil, which becomes packed, and the spread of disease is liable to be more rapid and extensive. The spread of nematode, if present in the lands, would also be greater. Over-cultivation is to be avoided, especially in the case of the lighter-bodied soils, as stirring the soil hastens the loss of organic matter and adversely affects the natural structure of the soil.

Priming. The removal of surplus leaves from the lower part of the plant is described as "priming." The first priming should be delayed until about four weeks after the planting of the crop. This has proved useful in the control of tobacco mosaic in the field. Apart from the removal of diseased and damaged leaves, especially from the bottom, no further priming should be done until the final priming, when the plants have reached the correct stage for topping.

Both operations may be carried out at one and the same time, but with the native labour employed in this country, it is advisable to have the tobacco primed by a gang of natives preceding those who are engaged in topping the plants. In order to control the spread of mosaic, it is recommended that labourers be required to wash their hands at frequent intervals, with soap and water, whenever they handle tobacco in the field. Further to lessen the risk of spreading plant diseases, the actual handling of the tobacco should be reduced to a minimum. All discarded leaves should be carted off the field and destroyed.

Topping and Suckering. In "topping," the terminal bud is removed from the plant to prevent the development of seed and

to produce the maximum development of good-sized leaf. The exact number of leaves which should be left on the plant cannot be definitely stated, but each plant must be treated as a unit and topped according to its merits. The correct number of leaves to each plant will be the number which it can carry to full development and maturity. When suitably topped, the plant will produce upper leaves almost the same size as those growing lower down the stalk. In deciding on the height of topping, the soil fertility and weather conditions are other factors which should be considered. The height of topping, also, has an important relation to the severity of infection from bacterial and fungal disease. Plants topped too low are more liable to severe attack by disease than tobacco which is topped too high.

When plants are topped too high the leaves do not develop body and the upper leaves are small, narrow and late in ripening. On the other hand, if topped too low, the plants produce coarse, rough, lifeless leaf which is slow in maturing and difficult to cure. Both experience and judgment are required in this operation, but as a guide it may be stated that the usual height of topping dark fire-cured tobacco is 10 to 12 leaves.

Topping should not be unduly delayed beyond the time for maximum results to be obtained. Delaying the topping wastes plant food and results in thin, papery leaf and reduced yield per acre. The stalk of the plant becomes tough as the flower head develops and the operation of topping is made more difficult. The proper stage at which tobacco should be topped is when the requisite number of leaves have developed and the bud has grown well above the topmost leaves. Topping should begin either before the flowers open or when the first flower opens, and it is advisable to go over the field every few days until all plants have been topped.

Shortly after topping, suckers will appear in the axils of the leaves. Sucker growth is rapid and they must be removed, or the whole object of topping will be defeated. For the best results the tobacco should be kept free from suckers at least until two-thirds of the leaves on the plant have been harvested. When a spell of wet weather occurs just as the tobacco is ripening, it may be advisable to allow the suckers to grow temporarily. Their growth will absorb plant food and help prevent secondary growth of the plants, which causes the leaf to become coarse and difficult to cure.

One necessary precaution to be taken during all operations dealing with priming, topping and suckering is the division of the labour gang into two sections—one to deal with clean, healthy plants, and the other to follow after and attend to those plants affected by mosaic and other diseases which may be present in the crop.

Seed Selection. An important factor in producing a satisfactory crop of tobacco is the use of good seed, which is true to type, and before topping commences the field should be gone over carefully in the final selection of desirable seed plants. As the quality of the seed will determine the quality of the following crop, it is essential that the selection of seed plants should be systematically carried on during the growing season from about eight weeks after

the tobacco is transplanted. Careful observation will reveal outstanding plants in the field, and provided they owe their superiority to inherent qualities rather than to more favourable cultural or soil conditions, they should be chosen for seed plants. Having decided upon the ideal type of plant desired, only those plants which conform to that type should be selected as seed plants. The main points in the selection of seed plants include good and uniform growth, number, size and shape of leaves, fine mid-rib and small veins, early maturity and resistance to disease and pests. The final selection, as already stated, is made just before topping, when the seed plants should be marked by removal of as many leaves from the top of the plant as would normally be removed in topping. Before the flowers open, all shoots except the "crow's foot" should be removed and the seed head made ready for bagging. Any flowers which may have already opened should be removed before covering the seed head with a paper bag. The object of bagging the seed plants is to prevent cross-fertilisation and to force self-pollination, thus transmitting the characteristics of the selected plant to the next generation. For this purpose a 14 lb. to 16 lb. light manila paper bag is placed over the seed head and tied securely but loosely to the stalk below the flowering branches. The bag should be pushed up on the stalk from time to time to accommodate the growth of the seed head. The bag should also be removed once a week and the seed head examined for worms, which should be removed along with the dead flowers before the bag is replaced.

The varieties of tobacco grown in Southern Rhodesia for fire-curing are named "Western" and "Little Crittenden."

Harvesting. The young tobacco plant when growing vigorously carries leaves deep green in colour, which at this stage are soft and pliable. This dark green colouration is a sign of a plentiful supply of nitrogenous constituents, which go to make up the vital or living parts of the leaf, and which are necessary for the building up of the food supply of the plant.

At about the time the leaves as a whole have reached their maximum power of elaborating the food supply, the flower head begins to develop. This food supply, consisting of starch and other substances, is carried from the leaf into the seed head to furnish the necessary food for the development of the seed. Then having fulfilled their purpose, the leaves pass naturally into the period of gradual decay.

As already stated, however, the terminal bud is removed from the plant to prevent the development of seed. The plants are also kept free of secondary shoots or suckers which develop after the plants are topped. Thus translocation of the food material from the leaves to other parts of the plant is arrested and both the size and body of the leaf are increased. The surplus food supply which accumulates in the leaf also induces ripening, and, later, unless the leaves are harvested, gradual decay.

Actual and personal experience is required before the grower is fully able to determine when tobacco is properly ripe, but the following description may prove helpful:—

Normally the crop will start to ripen approximately 90 days after the date of transplanting. The lower leaves ripen first and the top leaves are the last to reach maturity. The first indication of ripeness is a change in colour of the leaf, provided this change is not caused by conditions other than maturity of the plant. In seasons of severe drought or excessive rainfall, the leaves will often turn yellow before the plant is fully ripe. Plants affected by disease will also change colour prematurely; root-knot nematode or eel-worm is another common cause of this condition. The leaves of plants thus affected fail to cure properly, and lack the necessary quality.

The dark green colour of healthy, light-bodied leaf changes to a greenish-yellow as the tobacco reaches maturity. In the case of heavy-bodied leaf, the yellow may appear only in flecks or spots and the tip of the leaf curls down and in towards the stalk of the plant.

The accumulation of starchy material in the leaf causes it to become thick, brittle and the surface rough; this change from being pliable and smooth to the touch is another sign of ripeness. Such leaf will crack when folded and pressed between finger and thumb.

Generally, the higher up the stalk the leaves are, the more pronounced the change in colour and the general signs of ripening must be before they are ready for harvesting. Furthermore, the heavier the leaf, the riper it should be before picking. The number of leaves ready for harvesting varies according to the plant. Usually, however, from two to four leaves per plant reach maturity about the same time.

Successful curing of tobacco requires a combination of good judgment and careful workmanship. Much of the success in curing depends on harvesting the tobacco at the right time, when it is neither too ripe nor too green. For dark fire-cured tobacco the leaf should be fully ripe when harvested.

Tobacco may be harvested by cutting down the whole plant or by the removal of leaves individually. The former is an economical method as regards labour requirements, but has the drawback that all leaves on the plant are not in the same state of ripeness when harvested; also, there is an increased loss in weight of the leaf during the curing process. When harvesting by this method, it is advisable to use a suitable knife to split the stalk down the middle to within about six inches of ground level. Then the plant being held slightly down and away from the operator, with a slanting cut just above ground level sever the stalk from the root. The plants are then allowed to wilt slightly, after which they are placed astride the curing sticks. Each stick will hold from six to ten plants, depending upon the size of plants. When filled with their complement of plants, the sticks are next loaded on a wagon or motor lorry and transported to the barns. Tobacco should be carefully handled and protected from the sun by a hessian cover to prevent damage, bruising and sun-scald.

Harvesting by the single leaf or "priming" method is now generally adopted in Southern Rhodesia, as it has proved easier to fill the barn with leaf uniform in ripeness, body and texture. Usually

the number of pickings required to complete the harvest is from three to six, depending on the growth of the plants. By this method, leaf of uniform ripeness is picked and placed in crates or "machilas" specially constructed for the purpose. These crates are carried about the field, and when filled are conveyed to the stringing shed by wagon or motor lorry. Here the leaf is carefully removed from the crates and placed on tables or on the floor within easy reach of the natives employed in tying the leaf on to sticks. During the tying process, the sticks are supported on racks formed by posts let into the floor at intervals of about four feet and extending some three feet above floor level. The tobacco is strung in bunches of from two to four leaves, depending on their size, and in each bunch the leaves are placed back to back or mid-ribs towards the centre. When tying large, heavy leaf, only two leaves should be placed in each bunch.

Sail twine or soft string is used for tying the tobacco, one end being securely fastened to an end of the stick before the operator commences to deal with the leaf. When tying tobacco, the string should be wrapped approximately one and a half inches below the leaf butts. Placing the string lower than this results in bruising and discolouration of the base of the leaves. The string is held in one hand, and, with the other, a bunch of leaves is placed in position close to the stick. The string is then wound one and a half times round the leaf butts before the bunch is turned and slung over and across the stick to complete the operation. The next bunch of leaves is hung on the opposite side of the stick and about three inches in advance of the previous bunch. Thus the bunches are staggered down the length of the stick and the weight of the tobacco is supported by the string zig-zagging along the top of the stick.

When the stick is filled with tobacco—generally 32 bunches of leaves—the free end of the string is wrapped round and tied to the end of the stick, which is then ready for placing in the curing barn.

In packing the barn, the sticks of tobacco are hung up on tiers, starting from the topmost tier and working down to the lowest. Much damage may be caused by placing sticks, holding entire plants, in the wrong order. Any one tier should not be filled before another is commenced. The correct procedure is first to place one stick on the next tier down, with the butts of the tobacco plants just touching the tips of the plants suspended from the stick above. The next stick is then hung on the third tier down and placed in similar relation to the stick above, as indicated in the case of the first and second sticks. This order of filling is continued until the bottom stick has been suitably placed on the last tier, when the same order is observed by commencing again at the top and working downwards as before. This is continued until one section or "room" is filled. Each section is completed in proper sequence until the barn is fully packed. The filling of a barn should be commenced at a point furthest from the door, leaving the section by the door until last. The sticks are placed along each tier at intervals of from six to eight inches.

When filling the barn with leaf tobacco the method of packing may be changed. In this case the top tiers are filled with sticks

before starting on the next tiers down and so on, until the bottom tiers are reached. The spacing between the sticks is six inches.

In cured tobacco the colour, texture and quality of the leaf are the important features. When harvested before it is ripe, the leaf will retain a green colour, and if picked when over-ripe the colour will be uneven and blotchy, and the texture harsh and lacking quality.

It is essential also that the barn be filled with leaf which is uniform in ripeness, body and texture. If tobacco in different stages of maturity and varying in body and texture is placed in the same barn, there will be a corresponding variation in the curing rate of the leaf, and lack of uniformity in the cured product.

Curing. Curing is the descriptive term applied to the process by which the newly harvested tobacco is first coloured and then dried. Heat and moisture are the principal factors controlling the process of gradual starvation which the leaf is forced to undergo in curing. Curing is largely a physiological process, and the principal changes in composition must therefore be brought about before the leaf is killed. The surplus supply of food stored up in the leaf during the ripening period enables it to live for several days after harvesting.

When harvested, mature leaf is estimated to contain about 80 per cent. of water, most of which is lost during the curing, when it is gradually expelled from the tissue of the leaf. Certain chemical and physiological changes also occur which bring about those desirable qualities found in properly cured tobacco.

The rate of drying has an important effect on the result of curing. If the leaf is dried out too rapidly, it is killed prematurely and the curing ceases. On the other hand, if the rate of drying is too slow, the curing is prolonged. In either case the tobacco will be spoiled, firstly by remaining green in colour and harsh and lifeless in texture, and lastly by "sponging" and probably "pole sweat."

The first stage in the curing process is "yellowing," and this is accomplished by allowing the tobacco to hang in the barn for four to seven days, during which time the leaf should yellow. During this stage the temperature within the barn should register about 85 degrees F., and the relative humidity should not be too high or too low—say, 3 to 5 degrees F. difference between the wet and dry bulbs of the hygrometer. If the atmosphere is too dry, the leaf will tend to dry before the requisite yellow colour is developed. On the other hand, a saturated atmosphere will cause damage by discolouration and "pole sweat."

When necessary, the humidity of the air in the barn can be increased by wetting the floor and lower walls, or by keeping the doors and ventilators open during the night to admit the moist night air. In the event of the humidity becoming excessive, either through the application of too much water in the barn or to wet weather, the order should be reversed, and the barn closed at night and opened during the day, provided the weather is fine. Small fires may also be lighted before the leaf is fully yellow to reduce the humidity.

After four to seven days, when most of the tobacco is yellow, small, slow fires are made in shallow pits or trenches dug in the floor of the barn. Fire-curing, as the name implies, calls for the use of open fires, and the smoke from the burning wood imparts a creosotic flavour and distinctive aroma, besides improving the keeping quality of the tobacco. These smouldering fires, placed about six feet apart in the trenches nearest the walls, will usually suffice during the first few days. The temperature of the barn should be gradually increased from 85 degrees F. to 95 degrees F. and maintained at the latter temperature until the leaf is thoroughly yellow. If the outside atmosphere is dry and cool during this stage, it may be necessary to introduce moisture into the barn to stop the leaf drying out prematurely. This is achieved by frequent applications of water on the floor and lower walls. Care must be taken not to over-saturate the floor (especially earthen floors).

After the tobacco is a pronounced yellow, the temperature requires to be increased to 100 degrees F. and maintained there until the tips and edges of the leaf begin to curl and turn brown, which generally occurs in three to five days after the fires are lit. The fires must then be extingnished and the barn allowed to cool down and the sap to run back in the leaf, and the brownish coloured parts of the leaf to become pliable. The fires are re-lighted and the temperature raised to 105 degrees F. When the brown colour begins to spread from the edges of the leaf towards the midrib and the brown coloured part of the leaf becomes brittle, the fires should again be extinguished to allow the barn to cool down and the sap to spread. This process is repeated, and as the curing progresses the temperatures should be increased each time after the fires are re-lighted. After the leaf is a uniform colour, the midribs are dried out and the curing process is completed. It is seldom advisable to raise the temperature higher than 125 degrees F. The high degree of relative humidity should be maintained only during the yellowing stage. After this the moisture is gradually reduced.

The cured leaf should be of good size, good body and texture, and a uniform reddish-brown or dark brown colour. The desirable quality of the tobacco may be seriously impaired through being subjected to excessive quantities of smoke, which will leave heavy deposits on the leaf and blacken it. The fuel used for burning in fire-curing barns should be selected from hard woods, which do not create an unpleasant smell while burning. Shelled maize cobs form a suitable fuel.

During the earlier stages of curing, a heavy cloud of smoke is essential, but in the later stages, little or no smoke is required. When necessary, the fuel may be dampened with water to create a good cloud of smoke. In order to raise the temperature within the barn, the number of fires are increased. There should be no increase in the size of the fires already lighted. Large fires tend to dry out the tobacco too rapidly in localised areas and are also a source of danger in setting alight to the barn. As a precautionary measure, during the period of "firing," strips of wire-netting should be suspended close under the tobacco hanging immediately above the fire pits or trenches.

The curing process may be carried on either by retaining the fires in the barn overnight as well as during the day, or the fires may be extinguished each evening and re-lighted every morning. By the latter method the fires are extinguished at sunset, and if the weather is fine the barn door is left open overnight. Early next morning the fires are re-lighted and the barn closed up. This procedure is followed for eight or nine days, at the end of which period the tobacco should be a uniform brown colour. After the desired colour is obtained, and the web of the leaf has become brittle, the mid-rib is dried out, either by the continued use of open fires or by the use of hot air flues passing through the barns and connected to exterior furnaces. The use of hot air flues for the final stages of curing is recommended, because they reduce the curing time by approximately one week and lessen the risk of fire. The normal time required to cure dark fire-cured tobacco is roughly three weeks, but where the barn is fitted with flues and furnace, the curing will normally be completed in about two weeks.

Conditioning. After the tobacco is cured, it is extremely brittle and cannot be removed from the barn until the leaf is conditioned and made soft and pliable before being handled. Tobacco becomes soft when exposed to damp atmospheric conditions; these may be attained by the use of low-pressure steam, water, or a combination of both, in the barn. A conditioning pit may also be used.

When bringing tobacco into condition through the combined agency of water and the natural moisture of the atmosphere, the barn should be kept wet by sprinkling water on the floor and lower walls. The door and ventilators should be kept open overnight and closed during the day, except on misty days, when they should be left open to allow moist air to enter the barn.

Conditioning tobacco by filling the barn with low-pressure steam requires the use of a fairly large steam boiler (about 10 to 12 h.p.) placed conveniently close to the barns and grading shed. The use of steam renders the grower independent of the weather conditions and expedites the conditioning of tobacco.

Tobacco can also be brought into condition by being placed in a conditioning pit; this is the most desirable means of conditioning dark fire-cured leaf. First the tobacco should be partially conditioned in the barn by the application of water or steam in the barn as already described, or simply by wetting the floor and leaving the barn open overnight. Next morning the partially conditioned tobacco should be removed from the barn and placed in the conditioning pit, where it remains until the leaf has absorbed the requisite amount of moisture for bulking.

If the tobacco has been cured on the stalk, the leaves should now be stripped from the stalk and roughly sorted preparatory to being bulked. In the case of leaf cured on the stick, the leaves are untied and roughly sorted before bulking.

The characteristics of the cured tobacco are either improved or spoiled in the bulking and subsequent handling. Care should be taken not to over-condition the tobacco, otherwise the colour will darken and the quality deteriorate. On the other hand, the tobacco should not be too dry. When in proper condition for bulk-

ing, the web of the leaf and lower half of the mid-rib are pliable, but the upper half of the mid-rib should be only slightly supple.

Bulking. When ready, the tobacco should be bulked on wooden platforms which are supported on brick pillars built high enough to leave an air space of 12 inches between the floor and platform. The bulks may be built either with a circular or a rectangular base, the latter being the most economical as regards floor space. The bulks can be made any convenient length and width, and about six feet high.

In bulking the tobacco, the butts of the leaf should be placed to the outside and the tips in towards the centre. The tobacco is placed in position a handful at a time, and the outer edge forming the sides and ends of the bulk should be completed first. Then a second layer of leaf is placed with the butts about four inches in from the butts of the first layer. This forms a bond and keeps the outside of the bulk in place. In the centre of the bulk, the leaf is not placed in any particular relationship to the two outer layers. When one complete layer has been bulked, the next layer is placed on top, starting from the outside and working towards the centre as before; this procedure is continued until the bulk is completed. The corners of rectangular shaped bulks may be rounded off, as it is more difficult to make them square. The sides and ends should be kept straight and perpendicular.

When bulking, the leaf must be straightened, but should never be "pastelled" or flattened out. Weights are placed on the top of the bulk to press the tobacco down.

The bulks should be inspected carefully at regular intervals, and if any tobacco is found to be over-heating or becoming mouldy, the bulk must be broken down and rebuilt after the leaf has been shaken out and aired. When turning bulks, the tobacco which formed the centre of the old bulk is placed to the outside, and in the same way the tobacco from the bottom is placed on the top of the new bulk.

Grading and Baling. The initial sorting or grading is generally done when the tobacco is bulked. Finally, the leaves are assorted into three main grades, namely, trash, lugs and leaf:—

Trash consists of sandy and badly spotted or broken leaves.

Lugs consist of the smooth, usually light brown coloured leaves, taken from near the bottom of the plant.

Leaf includes all the sound, even coloured leaves taken from the plant after the removal of the trash and lugs.

The leaf grade should then be sub-divided into final grades according to colour, size, body and texture. The very heavy, oily and waxy leaf should not be mixed up with leaf which is lighter bodied and less oily and waxy. These are again sorted out according to length. The graded tobacco should then be tied in hands; the leaf grades should contain from 8 to 12 leaves to a hand, while the lug grades should contain from 12 to 18 leaves.

Each hand is tied with a leaf of similar grade suitably folded to form a binder. The binder should not be wrapped too far down

the hand; the top should be level with the butts and the lower edge of the binder not more than three inches below the top.

After the tobacco is tied, it is either bulked or hung on sticks until there is sufficient of any one grade to make a bale weighing approximately 170 lbs. The condition of the leaf is very important in the baling process. Too much moisture will put the tobacco in "high" condition and cause mould and discolouration of the leaf; too little condition will result in leaf breakage and scrap. The tobacco is in proper condition for baling when the web of the leaf is pliable, but not soft, and the mid-rib pliable for most of its length. Inferior grades are usually not tied in hands, but the mid-ribs are removed and the tobacco is baled and sold as strips.

Tobacco is baled in specially constructed baling boxes, which turn out standard sized bales of 34 inches in length, 24 inches wide and approximately 18 inches high. There are several patterns of baling boxes in general use: one design consists of two complete box sections which are hinged at three corners and fastened by a pair of hasps at the fourth; also a number of loose top and bottom boards or "lids" are required. The other types of boxes do not have sides made in two sections but have them in one piece, and instead of iron hinges, the corners are held in place by wooden battens fashioned to form a locking joint for the detachable end or sides, as the case may be. Loose tops and bottoms are also used with these boxes. Iron clamps for holding the boards on the bale as it is removed from the press are also in common use with all types of baling boxes.

When baling tobacco, the hessian and water-proof paper should first be placed in position in the baling box. Both these materials are of standard width, and the length required to cover a bale is 9 feet. When using boxes with loose tops and bottoms, the hessian and paper should be cut in lengths of 4 feet 6 inches. On the bottom board the hessian is placed first and then the water-proof paper, and the overlap is folded down and under the board, which is then placed in position at the bottom of the baling box. Next the hands of tobacco are placed in single layers with the butts towards the end of the box and the tips towards the centre; this is repeated at the other end, leaving the tips of both layers meeting or overlapping at the centre. Another layer is then placed over the first, but about 6 inches from the end of the box and so filling up the middle of the bale. The next layer in the box should be placed over the first, and so following the same sequence until the requisite weight of tobacco is packed. The centre layers should be alternately placed so that the butts are not all facing towards one end of the bale. The top board, complete with hessian and paper, is next placed on top of the tobacco, which is then pressed

down to give the required density. Before releasing the pressure, the box is dismantled and the iron clamps are placed in position to hold the top and bottom boards to the bale and prevent the tobacco from springing. The bale is allowed to set for a few hours and the hessian covering is sewn before the clamps are removed, and the bale is ready for stencilling and storage or despatch from the farm. In the case of loose-leaf tobacco, the method of baling is the same as for tobacco tied in hands. When baling, care should be taken not to apply excessive pressure to the tobacco, otherwise the value of the leaf will be seriously reduced through bruising and discolouration.

An increasing number of growers now send their crop to commercial tobacco graders for grading and packing for sale over the tobacco auction floors. Growers are well advised, however, to grade part, if not the whole, of their crop on the farm. The tobacco may then be handled to the best possible advantage, and in any case the grading of the crop is just as much the grower's job as any of the cultural and curing operations are.

In conclusion, it may be stated that the acreage planted should not be in excess of the barn and storage accommodation available. The planting of too extensive an acreage results either in wasting tobacco in the field or ruining the leaf during the curing through lack of barn accommodation and perhaps an inadequate labour force. The relative acreage allowance to barn space is roughly in the ratio of, say, 5 acres of dark fire-cured tobacco to each barn (25 ft. x 16 ft. x 17 ft.).

The primary objective should be the production of quality rather than quantity, and to this end intensive rather than extensive cultivation should be the policy adopted.

The Grassland Problem in Southern Rhodesia

By WILLIAM DAVIES, D.Sc., Director, Grassland Improvement Station, Stratford-on-Avon.

This report is based upon a tour of Southern Rhodesia made during the period 8th September to 19th November, 1947.

My term of reference was to review grassland problems in the Colony in relation to future development. Any consideration of the grasslands must essentially be related to pasture and livestock development. The whole question of the ley has to be integrated as part of a farming system in which for some long time the maintenance and proper development of veld and other uncultivated land will form a part. The ley and veld improvement must be closely related, the one to the other. Even in the most favoured districts of Rhodesia both veld and cultivated land form an integral part of the farming unit; therefore, to make the most use of that unit the farmer must be proficient in veld management as well as in the more intensive aspects of cultivation, cropping and the production of quality grass leys.

Itinerary. The itinerary followed in Southern Rhodesia has been as follows:—

8*th September.* Arrived Salisbury. Discussions Department Agriculture and Natural Resources Board.

9*th September.* Marandellas Grassland Experiment Station.

10*th September.* Salisbury Experiment Station. Gwebi Demonstration Farm and other farms in the Salisbury area.

11*th September.* Salisbury.

12*th September.* Marandellas, Rusape and Inyanga. Farm visits.

13*th September.* Inyanga Downs, thence to Umtali.

14*th September.* Umtali, Vumba and Penhalonga districts.

15*th September.* Umtali to Melsetter.

16*th September.* Melsetter to Chipinga. Farm visits.

17*th September.* Chipinga, Mount Selinda, Sabi Valley and Fort Victoria.

18*th September.* Fort Victoria to Beitbridge and the Limpopo low veld.

19*th September.* Beitbridge, Mazunga, Umzingwane River, West Nicholson, Gwanda and Matopos.

20*th September.* Matopos Pasture Research Station.

21*st September.* Matopos Pasture Research Station.

22*nd September.* Matopos, Bulawayo, Redbank, Bongola and Cawston (Umgusu sands). Farm visits.

23*rd September.* Matopos, Bulawayo, Insiza and Salisbury.

24*th September.* Salisbury. Addressed Rhodesia National Farmers' Union.

25*th September.* Salisbury to Sinoia. Farm visits.

26*th September.* Sinoia, Miami, Zambesi Plain, Chirundu Bridge.

27*th September.* Sinoia, Umvukwes, Concession, Mazoe Valley and Salisbury.

28*th September.* Marandellas Grassland Experiment Station.

29*th September.* Marandellas.

30*th September.* Return Salisbury. Addressed Natural Resources Board.

1*st October.* Native Reserves at Seki and Shiota.

2*nd October.* Salisbury.

3*rd October.* Salisbury. Addressed Rhodesian National Affairs Association. Discussions with Prime Minister, Minister of Agriculture and Departmental Officers.

4*th October.* Salisbury. Addressed Divisional Conservation Committee.

5*th October.* Salisbury, Hartley District.

6*th October.* Farm visits, Hartley District.

7*th October.* Hartley, Gatooma (Cotton Research Station), Que Que, Gwelo and Umvuma.

8*th October.* Umvuma, Enkeldoorn, Charter and Umtali.

9*th October.* Umtali and Penhalonga.

10*th October.* Addressed Eastern Regional Development Association at Umtali. Return Salisbury.

11*th October.* Salisbury. Addressed Department of Agriculture.

12*th October.* Salisbury.

13*th October.* Salisbury. Discussions Department Agriculture. Broadcast talk, "Grasslands of Southern Rhodesia."

14*th October.* Salisbury. Discussions with officers, Department Agriculture, Chairman, Public Services' Board, and Minister of Finance. Depart for Bulawayo.

15*th October.* Bulawayo to Victoria Falls.

16*th October.* Victoria Falls.

17*th October.* Leave for Bulawayo.

18*th October.* Bulawayo, Matopos Pasture Research Station, and return Salisbury.

19*th October.* Left Salisbury for Nairobi.

The completion of this itinerary has involved travelling some 5,000 miles, chiefly by car, during the course of the six weeks spent in the country. A considerable number of European farms were visited, and in connection with such visits I was privileged to meet groups of local farmers and to discuss their problems with them. I have been able to study the types of vegetation in the Colony. Much of this vegetation may be described as "much disturbed," although there are some examples of vegetation closely approaching to the "natural" form.

A proper appreciation of the ecological factors affecting both natural and induced vegetation is of fundamental importance. For that reason one welcomed the opportunity of visits to particularised farms in various parts of the Colony, and also of travelling during the hours of daylight, in order to gain a better picture of both the woodland and grass flora. The "natural" plant cover over most of Southern Rhodesia is woodland. Wherever open grassland occurs there is substantial evidence to indicate that this has been induced by the influence of fire and the biotic factor—frequently a recent influence, but often going back to pre-colonisation days. The visitor to Southern Rhodesia is made to realise that the original native population, in terms not only of humans and of domestic livestock, but also the native population of game and other fauna, must in the aggregate have played an enormously important part in the development of vegetation throughout the whole country.

Ley Farming and the Cropping Programme. In the agricultural development of Rhodesia nothing is likely to be of greater and of more fundamental importance than the establishment of sound systems of grassland farming. In such a development the place of ley must be paramount. The grass-legume ley is unique as a crop in the part that it can play in the upbuilding of soil fertility. It does this, moreover, at an accelerated rate, in proportion as to how well the ley is treated. The pasture in which the bulk of plant foods are returned to the soil builds up fertility at a greater rate than does an otherwise similar sward under hay conditions, and where hay is removed to be fed elsewhere. Not only does the ley build up soil fertility, but a dense sward is also a soil binder which can play an important part in the prevention of erosion under such conditions as pertain in Southern Rhodesia.

If the livestock industry of the Colony is to expand, as it surely must, then an ever-increasing degree of attention must be given to the ley and to grassland farming as a whole from the viewpoint of providing high quality food for livestock. It is the experience of almost every country in the world that well managed grass is the cheapest form of animal feed. The grassland potential of Southern Rhodesia is very great not only in the extension of beef production, but also in connection with the dairy industry. In a country with a rapidly increasing population it is highly desirable that a sound system of mixed farming be developed. The basis of this must be livestock and the ley.

The natural fertility of the soils as they occur under woodland in Rhodesia is not high. The farming industry is faced, therefore, with the problem of building up fertility to the point where not

only the usual arable crops can be grown but also of maintaining that degree of fertility so that the ley has a chance from the outset to be highly productive. The period in ley will still further enhance the standard of fertility in the soil, and thus maintain a still higher standard of crop yield. The problem is to replace woodland by good quality grassland in a balanced system of crop rotation. Clearing of woodland involves expense, and at the present time such cash crops as tobacco, maize, ground nuts, etc., provide a valuable means of paying for the initial clearing, cultivations and fertiliser treatment. As a result of cultivation, balanced cropping, and the application of plant food, soil condition is improved in preparation for the ley and for subsequent cropping. The necessity for a balanced system of livestock and mixed farming cannot be over-stressed, neither can the importance of establishing the best possible type of ley, having regard to local conditions.

At present there are a number of grasses which can be planted to produce good leys, but this work is no more than in its infancy in Rhodesia. There is need to determine the role that a whole range of other grasses, legumes and herbs, both indigenous and exotic, can play in the making of cultivated grassland. As these questions become clarified, so will grassland production be increased. Greater emphasis will then have to be placed upon correct systems of grassland management designed to maintain high pasture production over an extended season of the year. Closer sub-division of paddocks will be called for, adequate water supplies for the grazing animal will need to be made available and grassland farming will then become more intensified. The proper placing of contour banks, or, alternatively, of permanent grass strips designed for erosion control will need to be reviewed in relation to the new systems of farming. The whole question of small or localised irrigation schemes as an essential part of every farm is a matter that will need close study by both technician and farmer.

The Veld. The problems of the veld must be closely integrated with those of cultivated lands, particularly in districts where cultivated and uncultivated land occurs on the same farm. At the present moment the various types of veld (sweet, sour and mixed) are to a large extent under woodland of one type or another. In some areas, as around Gwelo, Enkeldoorn and in parts of the Eastern Border, there are considerable stretches of open grassland. The investigational work in progress in the Colony, as well as results obtained in other parts of Africa, show that to be of improved grazing value, the natural woodlands, wherever possible, must be thinned out to provide a park-like structure. In Rhodesia, the aim clearly must be to promote as dense a grass cover as possible, in order to provide maximum grazing and also to avoid erosion. To do this effectively, scrub and tree growth must be kept under close control. The aim is to promote a close growth of herbage. The advantage of retaining an uniform scatter of trees is not only to provide shade for the grazing animal, but, as in the case of the more valuable pod-bearing trees, to provide supplementary food for animals during the winter and spring months. On many areas of the sweet veld a variety of leguminous trees is to be found, and some of these bear valuable crops of edible pods. On most of the sour veld such trees do not form a part of the natural

woodland cover. Here is a matter of immediate interest, worthy of close study. It should be determined first which are the best pod-bearing trees from the viewpoint of nutritive quality of the pods, as such, and then to investigate the yield and other characters of these, under all sorts of veld conditions. It is important to know whether those valuable pod-bearing trees which occur naturally in the sweet veld can be induced to grow on sour and mixed veld. The experience already gained in Rhodesia suggests that the good condition maintained by cattle on sweet veld is in some part attributable to the fact that these cattle have available an annual crop of pods which provide them with supplementary feed of reasonably high quality during the winter and early spring. The grass flora at this time of year cannot be of more than roughage value, and the edible pods provide an important part of the diet. On sour veld where animals have little or no access to pods it is interesting to find that range cattle are normally in poor condition during late winter, whereas on sweet veld where pod-bearing trees grow naturally, animals do not fall in condition until the late spring when the crop of pods has finished and the new grass has not yet developed.

The Vleis. Vleis and other valley grasslands occur widely throughout Mashonaland on both granite and red soils. At the present time most of these vleis carry a poor type of indigenous vegetation, consisting chiefly of grasses and sedges. In their present state the vleis provide grazing in spring (October to December) and again in April and May. The majority of them are too wet either to graze or to mow during the rainy period (January to March), when growth elsewhere is at its maximum. The general condition of such vleis is poor, and although a considerable crop of nutritious material is grown each summer, this can neither be consumed, nor conserved, until after it has lost most of its nutritive value. On some of the native reserves, and particularly where centralisation has been carried on, the vleis are closely grazed throughout the period October to May. The result has been that the ground has hardened up, and in some respects these vleis have been considerably improved.

The vleis on European farms are normally sour, whereas on the heavily grazed vleis in such native reserves as Shiota, they have not only hardened up but have become much sweeter. The treatment imposed upon the vleis in native reserves may well be regarded as a pre-treatment, thus providing a measure of grassland improvement which should be followed by the introduction of new and more valuable herbage species. Because of their large aggregate areas, it is very necessary to conduct detailed investigations on the vleis. Already there are indications that certain introduced grasses provide swards of greater value than the indigenous herbage. For example, tall paspalum (*Paspalum urvillei*), swamp couch (*Hemarthria fasciculata*), *Acroceras macrum*, and others have not only established themselves on certain vleis, but have promoted a distinct increase in the grazing value of the land. It is not always easy to establish these grasses in the unimproved vlei. It should be much easier once the vlei has been hardened up and the growth kept under control during the summer months. On

certain vleis ploughing has been attempted, sometimes with moderate success. There is need for much experimental work to decide how best to introduce a new vegetation designed to replace the old and relatively worthless type. The vlei soils are usually acid. The value of lime and other manures should be investigated in connection with the whole thesis of vlei improvement.

Native Reserves. I have had the opportunity of inspecting Shiota and Seki Reserves in company with the Director of Native Agriculture. I have also made note of the condition of other reserves. There is evidence of widespread over-grazing of pastures and veld in all these. This has led to serious and wide-scale erosion, including marked donga formation in the vicinity of cattle tracks and roadways. The system of centralisation operating in some reserves has not overcome these features, and neither also will the mere reduction of stock now taking place on the reserves. If these areas are to be prevented from becoming waste lands, then the standard of grassland management operating on native reserves generally must be improved upon. Sound systems of rotational grazing must be in operation so that blocks of *similar* land can be rested while others are being grazed. It should be possible to do this immediately, even in the absence of fencing, since sufficient labour is available in the native areas to operate controlled herding.

Although centralisation offers certain advantages in the economy of the native reserves, it has not improved the grasslands, and indeed may well have promoted depletion. Under a system where one portion of the reserve is pasture and the other part arable, as on centralised reserves, grazing on the pasture section is too severe over a prolonged season of the year. In most cases the vlei land, when it forms part of the pastoral section, has hardened up and become sweeter. These vleis would respond to treatment, if control of grazing were developed and new grasses could be incorporated into them with good results. Vleis in the reserves may be regarded as having had (by heavy stocking) a useful form of pre-treatment. The next obvious stage is to bring about a further improvement by introduction of new species and to follow this by better methods of grassland management. However much good may have been accomplished by heavy stocking on these vleis, the danger now is deterioration. This has already started, and if the present hard grazing is continued much longer, then these vleis will go to waste. Many of them are already showing signs of serious donga erosion, due directly to the severity of grazing and treading.

The condition of the grazed veld and topland in the reserves is deplorable. Over-grazing and uncontrolled grazing has nothing short of devastated these lands where they occur within the pasture area of the reserves. Centralisation has made the position even worse. There is bush encroachment, marked soil erosion and loss of grass cover everywhere. This presents a land reclamation problem of the first order and must be tackled *immediately* if further loss on the land concerned is to be prevented. Where the sand veld is under arable cultivation and a sound rotation is being practised, then soil fertility is being maintained, but there is consider-

able scope for laying down land to grass, and the prevention of the return of woodland growth throughout the arable sections of the reserves. There must be closer collaboration between Native and European agriculture. The basal problems of fertility maintenance, ley farming, veld management and vlei improvement are the same whether under Native or European systems of farming. In any programme of research and investigation, the problems facing Native agriculture must take an important part, and the European Department specialists must be brought in to help solve the urgent land development problems facing the reserves.

In regard to extension services, it may be that Native agriculture has to be treated separately, but in research and the contacts made between specialist and extension worker, the problem must be faced as one whole and not as a separate problem divorced from the European research programme. There is, therefore, need for the closest possible collaboration between the European and Native Departments, a collaboration which at the present time simply does not exist.

Grassland Mapping. In order to determine the potentiality of each district, one of the first things to be done is to make a rapid survey of the country, with a view to constructing a grassland map, such as was done in England prior to the war. The vegetation map of Southern Rhodesia by Henkel (1931) provides a useful picture of woodland in the Colony, but this needs now to be supplemented by a comprehenve map showing the grassland types which will provide a basis for zoning the country. Such a map would be most useful in connection with the placement of experimental centres in different parts of the country; it would be followed by a map showing the potentialities of each district and the systems of farming appropriate to them. I understand that the latter type of map is now being considered by a Committee of the Department of Agriculture.

Systems of Farming and Potentialities. At the present time a rough picture can be drawn in relation to potentialities in the different districts. The Eastern Highlands, for example, from Inyanga to Melsetter and Mount Selinda represent a block of land some 200 miles long and perhaps of an average width of 20 miles. The rainfall is comparatively heavy, and the dry season shorter than most other parts of the Colony. The soils on the whole are fertile, and the area provides one of the most easily developed tracts of land from the view point of livestock farming and the production of cultivated leys. Dairying and other forms of livestock farming could be developed, and intensified almost at once, while there is abundant scope for afforestation, fruit growing and farm irrigation schemes. One draws a picture in these Eastern Highlands of forest-clad hillsides and of cultivated valleys where sown pasture would form the basis for an intensified livestock industry. The plough could well go round the farm with crops being grown for fodder, and the long-term ley used for both hay and grazing. There is already some evidence relative to the problem of appropriate seed mixtures, but there is urgent need for the establishment of investigational centres within this zone. The soils are acid and probably highly responsive to phosphate. It is

likely that the need for both lime and phosphate will be severely felt once these districts develop.

The larger part of Mashonaland is occupied by the granitic formation where sand veld with its included vleis are of widespread importance. Most of the sand veld is sour; *Brachystegia* woodland forms the natural cover. Flat or undulating land is largely cultivatable once the forest cover is removed. The future of this large block of land lies in the extension of cultivation and the production of high quality leys. All this means intensification of farming method. In the meantime, much improvement can be effected on land not in cultivation by the clearing of woodland and the production of park-like grassland. This will require fencing and a supply of water for stock, all at an accelerated pace. Any development programme will have to take into account the improvement of the vlei land. There can be no doubt at all that the sand veld on the granitic formation is capable of much intensified systems of farming. It is equally obvious that sown pasture must take an increasingly important place in the development of this large tract of country.

In such areas as the Mazoe Valley, and on the red soils where intensive cultivation has proceeded further than on the granite soils, further development must be along the lines of mixed farming with a livestock basis. The problem is to extend present systems of farming with the integration of the cultivated ley, and a systematic taking of the plough round the cultivatable land on the farm. On land not suitable for cultivation, improved management of the veld aiming for a park-like structure will be an essential part of the farming programme. In order to develop along sound lines where fertility of soil is not only maintained but improved upon, it is necessary to conduct investigations into systems of farming in relation to land improvement in these districts. The same principles will apply throughout the Colony where land is being brought under cultivation, whether the farm is on granite, dolerite, or on basement schists.

The problem of the veld under ranching differs from the problem in districts where cultivation is possible, yet the fundamental principles of veld management are the same everywhere. Under ranching conditions it may not be so easy to maintain park-like conditions, but wherever that can be done and the herbaceous flora thickened up, carrying capacity is likely to be increased, but even more important, erosion is kept under control.

The immediate problem in the ranching districts concerns adequate paddocking sufficient to ensure control of scrub. Also the provision of stock water, all of which will make possible a better system of grazing management on the ranch. Such developments as these require considerable capital expenditure, but they are absolutely necessary if the rancher is to be enabled to develop and improve his land rather than to exploit it. If the latter, then the ranching areas of Rhodesia will gradually be depleted and largely lost by erosion and bush encroachment.

Investigations in Africa, America and Australia have all shown that under semi-arid conditions the indiscriminate and uncontrolled grazing of woodland leads to serious soil erosion. As scrub growth

thickens, so erosion is accelerated. Under Rhodesian conditions, examples of eroded land are frequent, especially in the vicinity of the watering places where stock congregate and thus deplete the natural herbage. As one proceeds away from the watering places erosion is often less severe.

Grass and Afforestation. Afforestation is bound to play an important part in the development of agriculture in Rhodesia, for example, in the Eastern Highlands; the tree-planting schemes now proceeding are helping to provide a basis for land development. The forester is, however, inclined to plant large contiguous blocks of forest which might make difficult the creation of farm lands in those districts at some future date. It is desirable, therefore, for the agricultural and forestry interests to get together and to decide upon an all-embracing scheme of land usage in the different districts. I have drawn a picture in the Eastern Highlands of forest-clad hillside and cultivated valley. On the granite formations and the red soils of the midlands, the farm lands should be interspersed with belts of forest throughout the countryside. In these areas there are considerable stretches of steep, boulder-strewn hills which may never be useful as grasslands, and on which it might be possible to develop indigenous woodland. Regard would need to be paid to preserving and encouraging such woodlands from the viewpoint of the provision of fencing material and of fuel in the development of adjacent farm lands.

Livestock and the Provision of Livestock Feed. The following table indicates the trend in cattle and sheep populations on European and Native areas from 1916 to 1946. It will be seen that there was an appreciable increase in total cattle, which have doubled themselves between 1916 and 1926, then increased slightly further by 1936, since when there has been a further rise in numbers to the 1946 total of about 2,900,000. The total sheep population has been more or less static over the past 30 years. The number of goats, too, has remained more or less stable, with minor fluctuations from year to year. Horses have not increased, but donkeys have made a steady increase throughout the last 25 years and now number something approaching 100,000.

Numbers of Cattle and Sheep, 1916-1946 (aggregate of European and Native Holdings).

	Cattle.	Sheep.
1916	960,026	357,367
1926	2,188,682	331,694
1936	2,301,042	306,068
1946	2,905,011	324,720

Dairy production has made progress, but nothing spectacular. The number of cows regularly milked on European farms in 1946 was 48,695.

These data are interesting and very striking when one considers that the population, both European and Native, is expanding very rapidly.

The Colony is nowhere near self-supporting in livestock products as a whole. Apart from questions of soil fertility, therefore, it is incumbent upon Rhodesia to expand its grassland production by means of the cultivated ley. It must at the same time provide on an increasing scale fodder and arable crops to cater for an expanding livestock population. All this emphasises the need for research. In the case of the leys, the ideal will be to produce grass feed at all times of the year. This problem is on all-fours with that we are tackling in England at the present time. The grass ley without special management is extremely sensitive to climatic conditions, especially to rainfall and temperature. In Rhodesia, maximum growth is made during the summer rainy season and there is little or no growth during the dry period of the year. If, however, due regard is paid to the botanical make-up of the grasslands and to appropriate management of them, then the grazing season can be extended to provide high quality feed in early spring, before the rainy season starts, and to carry on through the autumn after the end of the rains. Certain species can commence growth in early spring and are thus able to make use of any showers that may occur at that time of the year. Within these species some strains of ecotypes will be more productive than the average, more leafy and with a still longer grazing season. To take advantage of grasses such as these needs investigation to fit them appropriately in the ley system as it develops in Rhodesia.

It has been found in other parts of the world, including Britain, that proper systems of management and of manuring of the sown pastures can make them productive over a still longer growing season. For example, many species and strains when rested during the period after stem production has been completed, show ability to conserve the leafage *in situ*, and even to make growth during the autumn months. The total production of a species is important, but of even greater importance is the capacity to produce over an extended season. The plant capable of a long growing season offers obvious advantages over one which has a shorter growing season. The grassland problem of Rhodesia, therefore, resolves itself not only into one of production of grass during the short rainy season but of extending the total period of growth and the provision of out-of-season pasturage. All this will need special purpose leys designed to extend the grazing season.

Farmers and technicians alike are aware of the lack of appropriate legumes in both cultivated and veld grasslands. Southern Rhodesia is not alone in this, however. The appropriate pasture legume for conditions of summer rainfall and winter drought has still to be found. Under a not dissimilar condition in Northern Queensland certain members of the leguminous genus *Stylosanthes* show some promise and these should be investigated under Rhodesian conditions. Most of the herbaceous legumes are intolerant of both soil acidity and of a low phosphate status in the soil. It will be necessary therefore in any comparative tests that may be made, to compare the material under conditions where these

fertilisers are applied as well as withheld. In many countries other elements, usually referred to as minor elements, are seriously deficient. Recent experience in South Australia is most indicative in this connection. Subterranean clover is well known as a valuable plant in South Australia, but until recently there were certain soil types on which subterranean clover would not grow. It has now been found that the correction of a minor element deficiency (in this case molybdenum) together with normal dressings of phosphate, has made possible the establishment of good quality clover pastures.

Research and Investigation. I have reviewed work recently started at both Marandellas and Matopos and have also studied the programmes prepared for the further development of pasture work at these two stations. Experiments already under way are basically sound in their conception and the teachings that will emanate from them are bound to provide a useful basis for pasture development under Rhodesian conditions. The experiments laid down at both stations in connection with veld improvement are well planned ecologically and will provide data of fundamental value relative to the question of veld management, the role of the mowing machine and of the fire stick. The experiments dealing with bush control and the development of park-like conditions on various types of veld are of great significance in relation to the carrying capacity of veld. It is important to develop these experiments so that complete data will be available relative to such questions as the relation of plant cover to the erodibility of soil, the introduction of appropriate pod-bearing trees to provide not only shade but a supplementary ration for the grazing animal. The further aims are to maintain the highest possible carrying capacity without introducing soil erosion.

Of equal importance to the veld work is that being established in relation to sown pastures. This work is in its early phases of development at both Matopos and Marandellas, but the preliminary results are supported by work accomplished at Salisbury and Gwebi. The work on plant introduction already carried out gives every indication that Rhodesia will find a considerable number of grasses which will be of value in ley farming on cultivated land. I regard this work of immediate importance for if Rhodesia is to develop her agriculture then she should use her cash crops, tobacco and the like, as means of making it possible to clear and cultivate more and more of the present day woodland soils. The acreage of cultivated land can enormously be extended. On European farms at the present time there is no more than about half a million acres of land in cultivation, whereas one may estimate that at least ten times as much cultivatable land is available. The ultimate figure may be as high as fifteen or even twenty million acres of ploughable and otherwise cultivatable land, if we include both European and Native agriculture. It is because of this huge potential that one lays such great stress that research workers should be given facilitities to investigate fully the whole question of plant introduction as well as of collection, selection, and ultimately of breeding the best among the grasses and other plants.

The earlier work at Marandellas, Matopos and Salisbury has played an important part in making the farming community of Rhodesia conscious of the value of crop rotations in relation to yield levels in cultivated crops and in relation to maintenance of a healthy soil. But these experiments have not gone nearly far enough. The foundations already laid must therefore be developed and the whole question of crop rotation with the ley as its pivot must be investigated in relation to systems of farming in which livestock and sound rotations are fundamental.

The fertiliser work carried out at Marandellas and Matopos on natural and improved veld did not show immediate promise having regard to costs and returns. This is not, however, a sound reason for discontinuing experimental work in relation to the application of inorganic as well as organic fertiliser. Not only is the testing of new species necessary but also these introductions must be subjected to different levels of fertility induced by the application of manure. They must also be tested in relation to the grazing animal with a view to extending the grazing season for as many months in the year as is possible.

The farmers of Rhodesia are already conscious of their duty towards the soil and given the appropriate information on how to establish the proper pasture plants would quickly embody that knowledge into their farming practices. There is everywhere a keenness for new knowledge, but there is little known about the solution of the ley problem in Rhodesia and this must be worked out in the country itself. In any sound programme of research one must emphasise the need for continuity. This class of work can normally only be sponsored and paid for by the State. It is work of such fundamental importance, however, in the development of the country that every possible means must be taken to remove it from the political arena. We have already the example of work being started about 1930 at Marandellas and Matopos. This work was discontinued during the retrenchment period which followed. Steps must be taken to see that this does not happen again for nothing is more wasteful of money or of human endeavour than to initiate long-term researches and then to discontinue them even before the foundations have properly been laid. Grassland research is a long-term affair, but the solutions of problems which can only be the outcome of research are so fundamental to the well-being of the land and its people that it should be given every possible priority. When one considers the national well-being in terms of social services and the rest, the lessons of history show that no nation can be great unless it looks after its agriculture and its land. The focal point is to maintain grassland as an integral part of agriculture from the view of soil improvement, erosion control, and the well-being of livestock. Under semi-arid conditions in Rhodesia the conservation of water becomes a matter of equal importance with these.

The prosperity of a country is largely determined by the fertility of its soils. Rhodesia is faced with the problem of building up soil fertility and this can best be done through the extension of mixed farming with an ever extending acreage of high class leys and permanent pasture. On the veld the problem concerns not

only extending the livestock industry but of holding the soil and preventing loss by erosion.

Organisation of Research. The central role played by grassland in connection with the maintenance of soil fertility, prevention of erosion, conservation of water and as food for livestock makes it imperative that the whole scheme of agricultural research should pivot around the problems of grassland. The principles of grassland production whether in terms of the ley or of the veld are essentially and fundamentally ecological, therefore, in the direction and organisation of agricultural research it is essential that principles of ecology should be fully and knowledgeably applied. The grassland worker must be fully conversant with ecological trends of the material with which he is working. It is emphasised that grassland research is so important to the proper development of agriculture as a whole that it must take the foremost place in the research programme of the Colony.

I have considered very fully ways and means of further development in grassland research. My conclusion is that there should be one central research centre fully equipped with a professional staff which as a team would be capable of investigating fundamental problems relating to the pastoral industry. The staff of the main station should consist of a director who would himself be trained as an agronomist and plant ecologist. He should have to assist him the following professional staff. One agronomist (with an assistant) who would investigate the problems of management and manuring in relation to available pasture plants; one plant breeder who would collect material from a wide variety of habitats, and ultimately select and produce improved types within the species; one chemist; one plant physiologist. The focal point at the Stations would be to produce better grassland, aiming, as far as possible, to produce pasturage and hay of high nutritive value capable of supporting animals all the year round.

In my view such a central and fully equipped station will be found necessary if grassland work is to be placed on a sound basis. In addition to the main station there should be seven sub-stations each to deal with local problems in the different districts of the Colony. At each of these sub-stations the problems of the ley and of the veld should be under investigation. At some stations the ley would be regarded as of greatest local importance both under dry land farming and under irrigation. At other centres the veld and the ranch would be given priority in the investigation programme. The staffing of the sub-stations would thus vary according to the problems concerned and to the importance of the district. Quite obviously the two existing stations at Matopos and Marandellas would provide centres dealing with important areas of the Colony. Both these stations, therefore, are sensibly located. The skeleton staff already established on them must be strengthened because at both centres ley, veld and irrigation (at Matopos) problems should be under trial. In addition to Marandellas and Matopos there should be stations at Melsetter and Inyanga to cover the eastern districts, also stations at Bongola and West Nicholson to cover respectively the country north-west of Bulawayo and the extensive ranching areas of the low veld. There should also be a station to

represent the northern area in the neighbourhood of Karoi; this would cover the soils of the Lomagundi geological formation. Finally there should be a station for the main maize growing areas on the heavier and more fertile soils of the Colony. This Station could in time serve as the central grassland research centre, which I feel so strongly should be developed. At each of the sub-stations it would be necessary to employ one and preferably two professional officers and to make the best use of such officers each of them should have two technical assistants.

Summary and Conclusions. The foregoing report deals primarily with grassland research and development. Emphasis has been placed upon the need for a full appreciation of the place that grass, whether as ley or veld, can play in the economy of land development. Grassland as the key crop will be the pivot around which future agricultural development is made. Unless Rhodesia expands her programme of grassland research and is able to put the fruits of that research into practice, then clearly there is danger of widespread land deterioration. The country is faced with the problem of building up soil fertility; in many cases of making soils anew. This can best be done through improved grasslands. The accepted role that compost and other forms of organic residues play in soil improvement throughout the cultivated lands of the country show the way. Similarly also does the response obtained by ploughing-in a leguminous forage crop. The future lies not in reducing the use of compost and of green crop, but in extending the grass ley. Compost has as its main limitation that the total amount available will always be exceedingly small in relation to total need and therefore a compost "substitute" is required. The ploughed-in annual crop is one substitute but again the acreage available is likely to be small in relation to the whole. The long duration ley (3 years and upwards) offers the alternative which can be applied over the widest possible range of conditions on cultivated lands throughout the Colony. The ley has the further advantage that it also provides valuable feed for livestock which means that stock numbers can be proportionately increased. The ley also builds up soil condition, creating an improved crumb-structure on heavy soils and adding cohesion to the light sands. Clearly throughout the Colony the need is for increasing the content of organic matter in the soils and this is likely to be done most economically by the ley. Whether in a system of leys or on the veld, an efficient cover, such as given by well managed grassland, is paramount in its ability to prevent soil erosion. Rain is able to percolate into the soil and therefore a good sward of grass adds to the water conserving capacity of that soil.

The recommendations made in this report are the minimum which should be considered. Rhodesia is a young country and must have belief in her future. Without undue optimism, it is obvious that her agriculture is capable of immense expansion. That expansion, however, will depend very much on what Rhodesia will do by way of agricultural research. She must be "big minded" and set in motion a well planned and properly conducted scheme of research in which grass and livestock should provide the foci.

To carry out such a scheme requires the closest possible co-ordination and the integration of all departments concerned. Well conceived research projects will always pay good dividends, but the ability to finance them will always also have limits. At the present time an even greater limiting factor is available staff. First class technical workers are in short supply in almost every country. It is, therefore, doubly important to integrate fully all the proposed research activities. In agricultural research Rhodesia should concentrate all her efforts towards building up sound systems of farming whereby the soils of Rhodesia will be preserved for future generations. Grassland improvement here provides the key.

In order to implement the proposals made in this report, and having regard to the limitations of staff, Rhodesia might well consider the possible secondment and/or exchange of technical personnel from other countries within the British Commonwealth. I feel confident that many young grassland workers from Britain, for example, would welcome the experience they would gain from a period of researching in Rhodesia. This could be brought about on the basis of exchange of staff between Institutions, or alternatively might be by secondment. Such schemes would be of immense all round benefit and would, I believe, play an important part in the promotion of sound research. It would have the added advantage of welding the bonds of Commonwealth as well as of bringing together workers in similar fields from all over the Empire.

Acknowledgments. I cannot end without acknowledgment of my debt to farmers, technical officers and others who have made my stay in Rhodesia both pleasant and profitable. I have at all times been greatly encouraged by the keen interest taken in the problem of grassland and of land development in Rhodesia. It would be impossible to name all those who not only gave me their help, but frequently went to some pains in order to do so. I must, however, record my particular gratitude to Mr. R. R. Staples, M.A., for the manner in which he organised my tour of Rhodesia, and also for the way he provided data, information and indeed every facility for which I asked.

Southern Rhodesia Veterinary Report

AUGUST, 1947.

General. Condition of cattle is rapidly falling off and deaths from poverty are commencing. The majority of these are in cattle moved for drought relief purposes. Four hundred and thirty-eight head of drought relief cattle were distributed from Salisbury during the month.

Tick Life is not very active.

Diseases: African Coast Fever. An extension of the disease was diagnosed on the farm Ypres, in the Chipinga area, where one death occurred on the 11th. Infection probably came from the farm Hartebeestnek. The farm Ypres was included in the cordon and short-interval dipping commenced. Owing to lack of condition of cattle, only seven-day dipping can be carried out on the infected farms. No deaths from African Coast Fever have occurred on any of the other infected farms in Melsetter and Chipinga.

Salisbury District. No deaths have occurred during the month on the farm Highlands. This means there has only been one case on the farm on the 7th May.

Anthrax was diagnosed on the farm M'bebi, in Salisbury area, where nine deaths occurred before inoculation. One death occurred on Scovini, Bulawayo district, and 2,000 head were inoculated.

Trypanosomiasis. One case was diagnosed in Chikwezo Reserve, Mtoko district, on the Portuguese East African border. This is the first case known to have occurred there. One case on Gungunyana, in the Chipinga area.

Lumpy Skin Disease. Only a few mild cases in Gwelo and Fort Victoria districts.

Piroplasmosis. Only six cases reported.

Anoplasmosis. Twenty-two cases reported.

Quarter Evil. Twelve centres of infection were diagnosed and the cattle inoculated.

Mallein Test. Ninety-three horses were tested with negative results.

Tuberculin Testing. Nine bulls, 19 cows, 17 heifers and 15 yearlings were tested with negative results.

IMPORTATIONS.

Union of South Africa: 10 bulls, 51 cows and calves (breeding), 7 sheep (breeding), 22 sheep (slaughter), 38 horses and mares, 48 geldings.

Bechuanaland Protectorate: 31 bulls (slaughter), 122 oxen (slaughter), 91 cows and calves (slaughter), 459 sheep (slaughter).

Northern Rhodesia: 5 horses and mares, 2 geldings.

United Kingdom: 1 pig (breeding).

EXPORTATIONS.

Northern Rhodesia: 65 bulls (slaughter), 24 oxen (slaughter), 416 cows and calves (slaughter), 300 sheep (slaughter), 4 bulls (breeding), 2 pigs (breeding), 36 donkeys (breeding).

Portuguese East Africa: 30 oxen (slaughter), 23 cows and calves (slaughter), 9 cows and calves (breeding), 3 bulls (breeding), 7 oxen (trek).

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage.

United Kingdom (lbs.): Beef, 26,110; bacon, 26,952.

Union of South Africa (lbs.): Beef, 56,750; fats, 58,994; offal, 10,048.

Bechuanaland Protectorate (lbs.): Beef, 2,717; bacon, 301; ham, 96; sausages, 455; fats, 390; offal, 271; pork, 18; brawn, 12.

Northern Rhodesia (lbs.): Beef, 384,866; bacon, 31,197; fats, 19,175; offal, 14,367; pork, 6,668; sausage casings, 27.

Portuguese East Africa (lbs.): Beef, 28,788; pork, 19,383.

Belgian Congo (lbs.): Beef, 350,674; offal, 19,296; veal, 10,745; poultry, 318.

Meat Products from Liebig's (Rhodesia), Ltd., West Nicholson.

Union of South Africa (lbs.): Luncheon roll, 1,583; corned beef, 28,025; ox tongue, 367; Vienna sausages, 300; steak and kidney, 120; curried beef, 1,800; Pate de Foie, 290; beef dripping, 17,850.

P. D. HUSTON,
Chief Veterinary Surgeon.

SEPTEMBER, 1947.

General. Cattle are still falling off in condition, but local showers at the end of the month may help them to hold condition in these areas. 1,141 drought relief cattle were distributed from Salisbury during the month.

Tick Life. Still inactive due to dry weather.

Diseases. African Coast Fever. Melsetter and Chipinga. No cases were reported on any of the infected farms. Dipping has still to be carried out at seven day intervals owing to the poor condition of the cattle.

Salisbury District: No cases were recorded on the infected farm Highlands.

Anthrax. One outbreak was recorded in Fort Victoria district.

Trypanosomiasis. No cases reported.

Lumpy Skin Disease. A few mild cases recorded in Bulawayo, Gwelo and Fort Victoria areas.

Quarter Evil. Eleven centres of infection were diagnosed.

Foot and Mouth Disease. Fort Victoria District: Disease was diagnosed on Humani Estate on the 21st and by the end of the month it had extended to Mpopas Section 7 Devuli Ranch, the Turgwe and Umkunda Paddocks and the Sengwe Reserve.

Chipinga District: Disease was diagnosed at Chisambanje on the 23rd, Gumera on the 24th, Chibuwe on the 25th, Rupisi and Chipangayi on the 26th. These are dipping tank areas situated from South to North along the Sabi River. The rapid spread was due to the fact that owing to the drought cattle were all concentrated along the bank of the river. In past outbreaks the Sabi River, owing to its size, has always acted as an efficient barrier to the spread of disease into the Chipinga district. This year owing to the drought the river consists only of pools which acted as points of contact for cattle from both banks.

Mallein Test. Eighty-nine horses were tested with negative results.

Tuberculin Testing. Eight bulls, seven cows, one hundred and ninety-one heifers and five yearlings were tested with negative results.

IMPORTATIONS.

Union of South Africa. 2 pigs (breeding), 22 bulls (breeding), 13 horses and mares, 64 geldings, 218 cows and calves (breeding), 50 sheep (slaughter).

Bechuanaland Protectorate. 464 oxen (slaughter), 79 cows and calves (slaughter), 31 bulls (slaughter), 499 sheep (slaughter).

EXPORTATIONS.

Union of South Africa. 2 horses and mares, 5 oxen (trek), 2 cows and calves (breeding).

Northern Rhodesia. 908 oxen (slaughter), 247 cows (slaughter), 46 bulls (slaughter), 45 donkeys, 322 sheep (slaughter).

Portuguese East Africa. 40 oxen (slaughter), 2 oxen (trek), 4 cows and calves (breeding).

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage.

United Kingdom. Offal, 8,723 lbs.; poultry, 14,338 lbs.

Union of South Africa. Beef, 339,219 lbs.; sausage casing, 4,914 lbs.

Bechuanaland Protectorate. Beef, 3,001 lbs.; bacon, 318 lbs.; ham, 11 lbs.; sausage, 625 lbs.; offal, 220 lbs.; pork, 112 lbs.; brawn, 24 lbs.

Northern Rhodesia. Beef, 326,639 lbs.; bacon, 20,247 lbs.; fats, 22,590 lbs.; offal, 28,062 lbs.; veal, 1,290 lbs.; mutton, 197 lbs.; pork, 10,711 lbs.; sausage casing, 32 lbs.

Belgian Congo. Beef, 358,237 lbs.; offal, 15,887 lbs.; veal, 4,471 lbs.; poultry 448 lbs.; mutton, 303 lbs.; pork, 5,499 lbs.; sausage casings, 112 lbs.

Meat Products from Liebig's (Rhodesia), Ltd., West Nicholson.

Union of South Africa. Corned beef, 228,600 lbs.; ox tongues, 6,372 lbs.; Oxford sausages, 11,160 lbs.; liver sausages, 7,875 lbs.; Vienna sausages, 43,125 lbs.; luncheon roll, 15,675 lbs.; Ideal Quick Lunch, 13,080 lbs.; steak and kidney, 38,760 lbs.; curried beef, 13,080 lbs.; babotie, 7,875 lbs.; jellied beef, 3,150 lbs.; pate de foie, 2,175 lbs.; potted beef, 7,613 lbs.; beef dripping, 6,450 lbs.; marrow fat, 27,525 lbs.

Belgian Congo. Corned beef, 9,000 lbs.

P. D. HUSTON,
Chief Veterinary Surgeon.

OCTOBER, 1947.

General. Rain has fallen in all districts and reports state that the cattle are improving in condition. Mortality has not been high, but has been worst in drought relief cattle that were moved to Salisbury and surrounding districts. The District Veterinary Surgeon, Fort Victoria, reports that it is remarkable that the cattle are in better condition than they were at this time last year.

During the month 1,173 drought relief cattle were distributed by the Cold Storage Commission from Salisbury.

Tick Life. Activity has been reported from all districts on account of the rains, and owing to lack of dipping during the past year this will increase.

Diseases. African Coast Fever. Salisbury District. No deaths occurred on the infected farm. Owing to poverty, the dipping interval had to be extended and a number of cattle too poor to dip have been sprayed with Gamatox.

Melsetter and Chipinga Districts. There have been no cases on any of the infected farms, which, owing to the condition of the cattle, are still on seven day dipping.

Anthrax. One case reported in Salisbury district and 72 in contacts were inoculated.

Trypanosomiasis. One case in Umzilezwe, Chipinga district.

Lumpy Skin Disease. A few mild cases reported from Bulawayo and Gwelo districts.

Quarter Evil. Eleven centres of infection were diagnosed and the cattle inoculated.

Foot and Mouth Disease. Fort Victoria. An extension to Ndanga East Reserve occurred on 24th October and this Reserve was included in the cordon.

On Devuli Ranch an internal cordon was established between the infectedand non-infected paddocks, but owing to the poor control of the cattle it is doubtful if this will be effective.

Chipinga District. An extension within the cordon area to Chisumbanjie was recorded on 3rd October, and as the infection was spreading slowly, inoculation was resorted to at Rupisi and Chipangayi with good results.

Sisal Estate, Tawona and Musani cattle, although within the cordon, have remained free of infection, and as the disease is now finished at Chipangayi which adjoins them it is to be hoped they will remain so.

Mallein Test. Sixty-four horses, including three foals, were tested during the month with negative results.

Tuberculin Testing. Sixty-eight bulls, thirty cows, seventy-eight heifers and five yearlings were tested with one reactor, a Jersey bull, which was sent on to Salisbury for re-test in a month's time.

IMPORTATIONS.

United Kingdom: 1 horse.
Northern Rhodesia: 1 horse.

Bechuanaland Protectorate: 89 oxen (slaughter), 19 bulls (slaughter), 12 cows (slaughter), 191 sheep (slaughter).

Union of South Africa: 62 bulls (breeding), 43 geldings, 19 horses and mares, 113 cows and calves (breeding), 91 sheep (breeding), 52 sheep (slaughter).

EXPORTATIONS.

Union of South Africa: 1 horse.

Northern Rhodesia: 6 bulls, 7 pigs (breeding), 20 donkeys, 79 sheep, 77 cows and calves (breeding).

Portuguese East Africa: 20 oxen (slaughter).

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage.

Union of South Africa: Fats 5,207 lbs., offal 44,971 lbs., pork 4,544 lbs., sausage casings 2,265 lbs.

Bechuanaland Protectorate: Beef 2,557 lbs., bacon 229 lbs., ham 21 lbs., sausage 324 lbs., fats 1,823 lbs., offal 225 lbs., pork 62 lbs., brawn 6 lbs.

Northern Rhodesia: Beef 314,455 lbs., bacon 19,587 lbs., fats 18,605 lbs., offal 16,779 lbs., veal 230 lbs., pork 1,200 lbs.

Belgian Congo: Beef 292,770 lbs., offal 8,118 lbs., veal 3,021 lbs., poultry 46 lbs., pork 2,965 lbs., sausage casings 486 lbs.

Portuguese East Africa: Offal 2,077 lbs., mutton 12,031 lbs.

Meat Products from Liebeg's (Rhodesia) Ltd., West Nicholson.

Union of South Africa: Corned beef 156,600 lbs., Vienna sausages 47,625 lbs., luncheon roll 14,625 lbs., Ideal Quick Lunch 11,400 lbs., potted beef 5,075 lbs., beef dripping 16,065 lbs., marrow fat 4,174 lbs.

PERCY D. HUSTON,

Chief Veterinary Surgeon.

SOUTHERN RHODESIA

Locust Invasion, 1932-47.

Monthly Report No. 178: September, 1947.

Red Locust: *Nomadacris septemfasciata*, Serv.

No reports of locusts in any stage of development within the Colony were received.

J. K. CHORLEY,
Chief Entomologist.

Monthly Report No. 179, October, 1947.

Red Locust: *Nomadacris septemfasciata*, Serv.

No reports of locusts in any stage of development within the Colony were received.

MERVYN C. MOSSOP,
Acting Chief Entomologist.

Monthly Report No. 180: November, 1947.

Red Locust: *Nomadacris septemfasciata*, Serv.

No Red Locusts in any stage of development within the Colony were reported.

MERVYN C. MOSSOP,
Acting Chief Entomologist.

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage.

Union of South Africa: Fats 5,207 lbs., offal 44,971 lbs., pork 4,544 lbs., sausage casings 2,265 lbs.

Bechuanaland Protectorate: Beef 2,557 lbs., bacon 229 lbs., ham 21 lbs., sausage 324 lbs., fats 1,823 lbs., offal 225 lbs., pork 62 lbs., brawn 6 lbs.

Northern Rhodesia: Beef 314,455 lbs., bacon 19,587 lbs., fats 18,605 lbs., offal 16,779 lbs., veal 230 lbs., pork 1,200 lbs.

Belgian Congo: Beef 292,770 lbs., offal 8,118 lbs., veal 3,021 lbs., poultry 46 lbs., pork 2,965 lbs., sausage casings 486 lbs.

Portuguese East Africa: Offal 2,077 lbs., mutton 12,031 lbs.

Meat Products from Liebeg's (Rhodesia) Ltd., West Nicholson.

Union of South Africa: Corned beef 156,600 lbs., Vienna sausages 47,625 lbs., luncheon roll 14,625 lbs., Ideal Quick Lunch 11,400 lbs., potted beef 5,075 lbs., beef dripping 16,065 lbs., marrow fat 4,174 lbs.

PERCY D. HUSTON,

Chief Veterinary Surgeon.

SOUTHERN RHODESIA

Locust Invasion, 1932-47.

Monthly Report No. 178: September, 1947.

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J. K. CHORLEY,
Chief Entomologist.

Monthly Report No. 179, October, 1947.

Red Locust: *Nomadacris septemfasciata,* Serv.

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MERVYN C. MOSSOP,
Acting Chief Entomologist.

Monthly Report No. 180: November, 1947.

Red Locust: *Nomadacris septemfasciata,* Serv.

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MERVYN C. MOSSOP,
Acting Chief Entomologist.

Rhodesian Milk Records.

OFFICIAL MILK RECORDS.

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Albert Vale Andre Van N6/332	G. Friesland	(Snr. 3 year) (Recalved 10.8.47)	10544.00	376.40	3.57	300	T. C. Pascoe, Crowborough Estate, Box 1253, Salisbury.
Albert Vale Marion Van N6/331	G. Friesland	(Jnr. 4 year) (Recalved 21.7.47)	10759.50	391.51	3.64	300	
Matopo Umsasa ...	Red Poll	(Jnr. 3 year)	6320.80	256.22	4.07	300	Government Experimental Station, P.B. 19K, Bulawayo.
Matopo Utopia ...	Red Poll	(Jnr. 3 year)	8016.20	263.01	3.28	300	
Matopo Nightingale	Red Poll	Mature	7917.90	267.96	3.38	300	
Matopo Usherette	Red Poll	2 years	4351.80	172.32	3.96	300	
Dewdrops Gipsy ...	Guernsey	Mature	5218.00	242.74	4.65	300	E. J. Hards, P.B. Marandellas.
Azanas Amy	Jersey...	Snr. 3 year	5524.00	259.37	4.30	300	J. H. Keightley, Moorefield, Glendale.
Katinka Nancy ...	Jersey...	1 yr. 8 mths.	5976.50	257.78	5.08	300	

SEMI-OFFICIAL MILK RECORDS.

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Ten...	G. Friesland	Mature	8119.00	258.49	3.18	300	D. A. Allan, Pendennis, Avondale.
Bress	G. Friesland	Mature	9706.80	369.73	3.81	300	
Sinoia	G. Friesland	Mature	6413.00	244.29	3.81	300	
Agnes	G. Friesland	Mature	7476.70	282.62	3.77	300	
Kaponda	G. Friesland	Mature	6695.40	246.54	3.68	296	
Mashuka...	G. Friesland	Mature	7716.50	264.44	3.43	300	
Rhodia	G. Friesland	Mature	7970.70	272.42	3.41	300	
Chikumbo	G. Friesland	Mature	7539.50	283.58	3.76	300	
Sirenga	G. Friesland	Mature	6160.40	226.17	3.67	261	

Raynor	G. Friesland	Mature	5776.00	243.26	4.21	300	G. R. Anderson. Box 8. Gwelo.
Ababa...	G. Friesland	Mature	6869.00	240.82	3.51	268	R. A. Ballantyne, Box 801, Salisbury.
Bonsella...	G. Friesland	Mature	6260.00	274.53	4 39	300	
Natal...	G. Friesland	Mature	6032.00	229.23	3.77	300	
Bandidi	G. Friesland	Mature	8152.00	269.67	3.31	300	
Bremen	G. Friesland	Mature	6853.00	255.83	3.73	300	
Panne...	G. Friesland	Mature	7081.50	244.59	3.45	300	N. G. Barrett, Gavenny, Rusape.
Potsdam...	G. Friesland	Mature	5695.10	235.77	4.14	300	J. A. Baxter, Box 1368, Salisbury.
Strand...	G. Friesland	Mature	7566 20	259.73	3.43	300	
War	G. Friesland	Mature	9457.10	340.02	3.60	300	
No. 71	G. Friesland	Mature	9264.10	346.76	3.74	300	A. L. Bickle, Box 595, Bulawayo.
D97	G. Friesland	Mature	10902.50	356.00	3.27	300	
D101	G. Friesland	Mature	10637.50	352.08	3.30	300	
D72	G. Friesland	Mature	9872.60	335.20	3.40	300	
D85	G. Friesland	Mature	6616.90	295.45	4 47	285	
D99	G. Friesland	Mature	10037.40	342.59	3.41	300	
D149	G. Friesland	3 years	6978.40	276.73	3.97	300	
D135	G. Friesland	Mature	8464.80	317.63	3.75	300	
Hope III.	G. Friesland	4 years	6259.70	256.25	4.09	300	Mrs. M. Black(Burnside, Bindura.
Katie III.	G. Friesland	4 years	5988.20	252.35	4.22	300	
Punch II.	G. Friesland	2 years	5881.20	227 04	3 88	300	
Bindura II....	G. Friesland	3 years	5717.00	245.06	4.29	300	
Katie IV.	G. Friesland	3 years	6265.70	247.93	3.96	300	
Marty II.	G. Friesland	2 years	6338.20	237.46	3.75	300	
Mary II....	G. Friesland	4 years	6762.20	272.16	4.02	300	
No. 2	G. Red Poll	Mature	6398.00	274.63	4.29	283	P. A. Bowen, Box 893, Salisbury.
No. 9	G. Red Poll	Mature	6988.00	362.10	5.18	269	
No. 271	G. Friesland	3 years	7297.00	247.74	3.40	300	C. Boyd Clark, Mount Zonga, Inyazura
Notice	G. Friesland	Mature	5816.00	234.15	4.03	300	Ed. Butler, Woodlands, Shamva.
Tania	G. Short/Ayr. ...	Mature	5585.50	229.10	4.10	300	L. E. O. Carey, Clovelly, Trelawney.
Mary	G. Friesland	Mature	7168.00	235.28	3.28	281	Christo & Wilson, Box 110, Gwelo.

SEMI-OFFICIAL.—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Sandra I.	G. Friesland	2 years	7267.00	271.02	3.73	300	T. Cousins, P.B. 20, Gwelo.
Nyasaland	G. Friesland	Mature	7301.50	270.20	3.70	300	J. Cumming, Hillside, Norton.
Kooi	G. Friesland	Mature	6308.50	238.61	3.78	300	
Angelier	G. Friesland	Mature	6911.30	261.18	3.78	265	Daisyfield Orphanage, P.O. Daisyfield.
Poppie	G. Friesland	Mature	6678.00	234.60	3.51	257	
Witmuis...	G. Friesland	Mature	7043.80	248.09	3.52	253	
Lena	G. Friesland	Mature	8058.20	323.85	4.02	275	
Maphosa	G. Friesland	Mature	8989.20	452.72	5.04	300	
Engela	G. Friesland	Mature	9398.80	308.12	3.28	300	
Lappie	G. Friesland	Mature	6878.30	280.53	4.08	300	
Liefling	G. Friesland	Mature	10508.40	347.37	3.31	300	
Pingi	G. Friesland	Mature	9296.00	322.19	3.47	300	A. C. De Olano, Blue Waters, Bromley
Mary	G. Friesland	4 years	7146.00	265.38	3.71	251	
No. 225	G. Friesland	Mature	6819.00	244.11	3.58	272	Mrs. M. Everard, Castle Zonga, Inyazura.
No. 153	G. Friesland	Mature	8432.00	310.09	3.68	291	
No. 244	G. Friesland	4 years	7683.00	291.22	3.79	300	
No. 176	G. Friesland	Mature	5966.00	237.06	3.97	236	
Suzanne II.	G. Friesland	Mature	6672.00	240.54	3.61	300	
No. 246	G. Friesland	4 years	7019.00	260.02	3.70	300	
No. 124	G. Friesland	Mature	6596.00	247.12	3.75	292	
No. 57	G. Friesland	3 years	7026.50	252.01	3.58	300	H. C. Fischer, Olivia Farm, Headlands.
No. 3	G. Friesland	Mature	6953.50	238.72	3.43	300	
No. 292	G. Friesland	Mature	10966.00	437.21	4.33	300	
No. 70	G. Friesland	3 years	7499.00	276.36	3.69	300	
No. 24	G. Friesland	Mature	7599.00	274.29	3.51	300	
No. 223	G. Friesland	Mature	6652.50	242.41	3.67	254	
No. 30	G. Friesland	Mature	12397.00	449.25	3.62	300	R. le S. Fischer, Wakefield, Headlands.
No. 107	G. Friesland	3 years	10328.00	423.31	4.09	266	
No. 64	G. Friesland	4 years	9204.00	295.14	3.21	271	
No. 88	G. Friesland	3 years	6933.00	312.19	4.50	300	

No. 480	G. Friesland	Mature	6618.00	279.73	4.23	285	W. F. Fischer, Coldstream Dairy, Headlands.
No. 441	G. Friesland	Mature	6718.00	266.36	3.96	300	
No. 482	G. Friesland	4 years	7165.00	281.16	3.92	300	
No. 389	G. Friesland	Mature	6849.50	281.34	4.11	246	
No. 450	G. Friesland	Mature	7631.00	299.79	3.93	300	
No. 415	G. Friesland	Mature	7276.50	247.68	3.40	300	
Betty	G. Guernsey	Mature	4765.70	228.08	4.58	300	G. J. Franklin & Son, Box 105, Umtali.
Bulbul	G. Friesland	4 years	5220.20	226.88	4.35	300	
Hopbeer	G. Friesland	Mature	10873.90	392.34	3.61	284	
Jean	G. Guernsey	Mature	6054.40	273.08	4.51	300	
Mimi	G. Friesland	Mature	11104.90	413 12	3.72	300	
M'Dondo	G. Friesland	Mature	9716.50	357.01	3.67	300	
Socks II....	G. Friesland	Mature	10192.30	422.82	4.15	300	
Sore Hoof	G. Guernsey	Mature	5850.20	273.64	4.68	300	
Sally	G. Shorthorn... ...	Mature	3775.00	372.98	4.25	300	
Ganganda	G. Friesland	Mature	5594.60	279.70	5 00	300	
Freda	G. Guernsey	2 years	6260.00	243.67	3.89	300	
White I....	G. Friesland	Mature	5588.40	247.02	4.42	300	
P'Horro II....	G. Shorthorn... ...	Mature	5772.90	257.15	4.45	300	
Poppy	G. Friesland	Mature	9264.90	358.54	3.87	300	
Mitzi	G. Guernsey	Mature	5466.00	267.22	4.89	300	
Button II.	G. Guernsey	2 years	4419.90	228.13	5.16	300	
No. 190	G. Friesland	4 years	8506.60	282.39	3.32	300	P. Freeland, Lingfield, Gwelo.
No. 40	G. Friesland	3 years	7689.10	267.51	3.48	300	
Benzie...	G. Friesland	Mature	7544.40	255.98	3 39	300	
Sofie	G. Friesland	Mature	9618.40	294.32	3.06	300	
Kanda 64...	G. Friesland	Mature	8866.00	279.32	3.15	300	
Lulu	G. Friesland	3 years	7608 60	249.68	3.28	300	
Blackie	G. Common	Mature	6408.80	234.08	3.65	300	G. G. Futter, Marjoribanks, Gwelo.
Bessie Bell	G. Common	Mature	6186.20	228.13	3.69	300	
No. 120	G. Friesland	Mature	5534.80	244.72	4.42	300	W. N. Gebbie, P/B 19A, Salisbury.
No. 103	G. Friesland	Mature	5221 20	238.09	4.58	300	
No. 137	G. Friesland	Mature	5415.00	244.25	4.51	300	
No. 147	G. Friesland	Mature	5263.10	231.75	4.40	287	
No. 113	G. Friesland	Mature	5544.20	231.18	4.17	300	
No. 118	G. Friesland	Mature	5113.90	229.63	4.49	257	
Stewart...	G. Friesland	Mature	5402.40	240.96	4.46	300	G. F. Gebhart, Box 190, Gwelo.
Holly	G. Friesland	Mature	10770.00	332.92	3.10	300	Humphrey Gibbs, P.B. 52L, Bulawayo.
Ducky	G. Friesland	Mature	6205.00	229.07	3.69	300	

SEMI-OFFICIAL—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Maria...	G. Friesland	Mature	8801.00	269.73	3.00	300	Humphrey Gibbs, P.B. 52L, Bulawayo.
Audrey	G. Red Poll	Mature	10952 00	348.51	3.17	300	
Star	G. Friesland	4 years	8349.00	257.35	3.00	300	
No. 174	G. Red Poll	Mature	8571.30	305.83	3.57	300	Govt. Experimental Stn., P.B. 19K, Bulawayo.
No. 65	G. Friesland	2 years	8190.60	283.61	3.46	300	Grassland Experimental Stn., Marandellas.
Early Bird D168 ...	G. Friesland	2 years	6779.20	275.51	4.00	300	E. E. C. Green, Box 879, Bulawayo.
Typhoon	G. Friesland	Mature	7532.60	239.09	3.17	295	Gwebi Govt. Farm, P.B. 76B, Salisbury.
Gladiator	G. Friesland	Mature	7982.00	273 48	3.55	300	
Vengeance	G. Friesland	Mature	7323.50	267.32	3.65	247	
Lodestar...	G. Friesland	Mature	9638 00	323.57	3 36	295	
Spitfire	G. Friesland	Mature	7577.50	237.88	3.14	249	
Betty	G. Guernsey	Mature	5945.40	280.16	4.71	300	D. A. Harley, Harleyton, Beatrice.
Ada	G. Guernsey	Mature	6044.20	263.16	4.35	300	
Dainty	G. Guernsey	Mature	8249 20	294.29	3 57	300	
Eileen	G. Guernsey	Mature	7524.80	346.19	4.61	300	
Isobel...	G. Friesland	Mature	7912.60	338.27	4.28	300	
Charlotte	G. Guernsey	4 years	5952.70	239.59	4.02	248	
Grace	G. Friesland	Mature	8954.00	321.13	3.59	300	Mrs. C. Harrison, Box 58, Shamva.
Marjorie	G. Guernsey	Mature	6981.00	314.46	4.50	300	Mrs. L. M. H. Howard, Nengwa, Beatrice.
Vicky	G. Guernsey	Mature	7427.70	327 80	4.41	300	
Phyllis	G. Guernsey	3 years	7454.60	305.66	4.10	300	
Patsy	G. Guernsey	3 years	6320 00	325.59	5.15	300	
Cimaron	G. Guernsey	3 years	5494.30	304.55	5.54	300	
Jewel	G. Guernsey	3 years	6640.80	254.80	3.84	300	
Mablos	G. Friesland	Mature	6538.50	228.24	3.49	286	L. Huddy, Amalinda, Salisbury.
Ivy	G. Friesland	Mature	7632.70	251.85	3.30	254	
Radio	G. Friesland	4 years	6647.30	281.55	4.24	298	
Immigrant	G. Friesland	Mature	7370.20	310 53	4.21	300	
Rose	G. Guernsey	4 years	8295.10	284.12	3.43	256	

No. 6	G. Friesland	Mature	6775.10	243.48	3.59	300	Sir G. M. Huggins, Box 671, Salisbury.
Gwen	G. Friesland	2 years	7184.60	251.50	3.50	284	
June	G. Friesland	3 years	5782.50	233.31	4.03	300	Mrs. Y. V. Russell-James, Mazarita, Golden Valley.
Gem	G. Red Poll	Mature	4125.50	239.64	5.81	272	A. Patton Jamieson, Dunsappie, Theydon.
J.J.67/2/1	G. Friesland	2 years	8865.00	304.17	3.43	300	J. Jamieson, Box 217, Bulawayo.
J.181/1	G. Friesland	3 years	14678.00	454.37	3.10	300	
J.64/1	G. Friesland	Mature	11580.00	414.19	3.58	300	
J.J.185	G. Friesland	Mature	11158.00	392.64	3.52	300	
J.J.88/2	G. Friesland	2 years	7656.00	297.89	3.89	300	
J.176/1...	G. Friesland	3 years	13176.00	453.64	3.44	300	
K17	G. Friesland	Mature	6777.50	245.65	3.62	300	B. H. Kew, Box 972, Bulawayo.
K28	G. Friesland	Mature	7852.70	262.12	3.34	300	
No. 5	G. Here/Fries. ...	Mature	7326.80	289.37	3.91	300	
K22	G. Friesland	Mature	6979.70	259.19	3.71	300	
J.66	G. Friesland	Mature	7770.90	306.58	3.95	300	
K16	G. Friesland	Mature	6516.00	289.84	4.45	300	
K2	G. Fries./Here ...	Mature	8428.60	347.23	4.12	300	
Nelly	G. Friesland	Mature	6511.90	232.01	3.55	300	D. King, Rockwood Farm, Concession.
Clare	G. Friesland	4 years	4888.00	242.55	4.95	249	
Bauhinia.	G. Friesland	Mature	7717.40	298.72	3.87	247	
Kolmeis	G. Friesland	Mature	6263 50	231.66	3.70	247	
Monkey Nuts	G. Friesland	Mature	6910.70	272.34	3.94	300	H. Knill, Mendamu, Marandellas.
Meg	G. Friesland	Mature	9148.60	351.39	3.84	300	
Odera II.	G. Friesland	2 years	6186.60	232.94	3.77	281	
Pinafore II.	G. Friesland	2 years	6196.50	271.61	4 38	300	
Borki III.	G. Friesland	3 years	6300.50	266.00	4.22	300	
Sixpence	G. Friesland	Mature	7011.90	248 87	3.55	300	P. Linton, Box 898, Salisbury.
Thomson...	G. Friesland	Mature	7675.50	284.26	3.70	300	
Maplank...	G. Friesland	Mature	7537.70	292.05	3.87	300	
Brown II.	G. Friesland	Mature	7863.20	328.93	4.18	300	
Bichane	G. Friesland	Mature	7187.60	260.03	3.62	300	
Tennis I.	G. Friesland	Mature	7328.20	268.25	3.66	300	
Tengaye II.	G. Friesland	Mature	8066 40	296.00	3.67	300	
Makuni II....	G. Friesland	Mature	7736.30	308.89	3.99	300	
Spot I.	G. Friesland	Mature	7561.70	299.51	3.96	300	
Skea II.	G. Friesland	Mature	6794.10	305.14	4.51	300	
Spot II.	G. Friesland	4 years	8340.40	276.62	3.32	300	

SEMI-OFFICIAL—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner
Cranbourne...	G. Friesland	Mature	7807.70	278.68	3.57	300	C. J. Marshall, Box 654, Bulawayo.
Myra	G. Jersey...	Mature	6115.60	341.33	5.58	300	Lieut.-Col. C. I. F. Maynard, P.B. 112C, Salisbury.
No. 337	G. Guern/Fries.	Mature	8951.30	389.57	4.35	300	J. R. McLaren, Safago, Gwelo.
No. 435	G. Guernsey	Mature	6208.70	230.68	3.72	300	
No. 407	G. Guernsey	Mature	6729.50	273.87	4.07	300	
Crest	G. Friesland	Mature	5479.50	239.76	4.38	228	
No. 469	G. Guernsey	2 years	6142.80	266.07	4.33	276	
No. 335	G. Guern/Fries.	Mature	9038.20	325.09	3.60	248	
No. 365	G. Guern/Fries.	Mature	10021.30	359.53	3.59	300	
No. 429	G. Guernsey	4 years	7360.30	297.96	4.05	300	
No. 333	G. Guern/Fries.	Mature	9464.50	335.79	3.55	300	
Bandrock	G. Ayrshire	Mature	8106.40	305.88	3.77	300	L. McLean, Box 161, Gwelo.
Longone No. 14 ...	G. Friesland	Mature	6018.60	233.47	3.88	300	
G42/3	G. Friesland	3 years	6352.00	244.51	3.85	300	Meikles Trust & Investment Co., Ltd., Leachdale Farm, Shangani.
25/9	G. Friesland	Mature	9571.00	288.19	3.01	300	
No. 21/8	G. Friesland	Mature	10177.00	392.35	3.86	300	
No. 20/7	G. Friesland	Mature	12455.00	436.73	3.51	300	
No. 24/7	G. Friesland	Mature	11748.00	391.89	3.34	300	
No. 4/9	G. Friesland	Mature	12114.00	382.44	3.16	300	
No. G.30/0	G. Friesland	Mature	10411.00	352.55	3.39	300	
No. P.15/0	P.B. Friesland ...	Mature	10274.00	340.82	3.32	300	
No. P.25/0	P.B. Friesland ...	Mature	10631.00	370.25	3.48	300	
Mitchlin Winona ...	P.B. Friesland ...	3 years	11340.50	414.44	3.65	300	W. S. Mitchell, Springs, Iron Mine Hill.
Mitchlin Dainty D.	P.B. Friesland ...	2 years	8047.00	252.09	3.13	300	
Mitchlin Dorina D.	P.B. Friesland ...	3 years	7207.00	248.16	3.44	300	
Lesita	G. Friesland	Mature	7797.80	332.05	4.26	300	Cmdr. E. L. Morant, Marirangwe, Salisbury.
Quail	G. Ayrshire	Mature	6546.40	271.66	4.15	300	
Mazoe	G. Friesland	Mature	5559.10	227.02	4.08	300	

Farau	G. Friesland	Mature	7924.90	248.53	3.14	300	G. R. Morris, Box 1040, Salisbury.
Polly	G. L.R./Short ...	Mature	8181.90	352.23	4.30	300	
Lucia	G. Friesland	Mature	7646.90	257.09	3.36	300	
Ionela	G. Friesland	3 years	8756.50	279 84	3.20	300	
Shabani	G. Friesland	4 years	6120.50	232.51	3.80	300	
Malingosi	G. Friesland	Mature	9287.50	315.11	3.39	300	
No. 127	G. Friesland	Mature	9636.00	311.48	3.23	300	F. B. Morrisby, Box 36, Gwelo.
No. 147	G. Friesland	Mature	7084.00	240.21	3.39	278	
Fanny	G. Friesland	3 years	7336.00	246.79	3.36	300	
No. 150	G. Friesland	Mature	8222 10	317.05	3.86	300	T. C. Pascoe, Box 1253, Salisbury.
No. 69	G. Friesland	Mature	9019.10	355.35	3.94	300	
No. 199	G. Friesland	Mature	4887.50	225.69	4.62	300	
No. 88...	G. Friesland	Mature	6910.30	253.23	3.66	300	T. C. Pascoe, Box 1253, Salisbury.
No. 103	G. Friesland	Mature	6179.30	239.94	3.88	300	
No. 13...	G. Friesland	Mature	8348.00	279.92	3.35	300	J. Picken, Iron Mine Hill.
Sandy	G. Friesland	Mature	6476.00	268.97	4.15	300	Mrs. Worthington Reid, Clifton Down, Gwelo.
Orvorn	G. Friesland	Mature	5937.80	225.47	3 80	278	Mrs. M. Rogers, Bickford Farm, Gwelo.
Danga	G. Friesland	Mature	6735.50	251 20	3.73	300	
Simon	G. Friesland	4 years	8010.60	392.25	4.89	300	W. F. H. Scutt, Maple Leaf, Norton.
Poppy...	G. Friesland	Mature	7030 00	239.74	3.41	300	Susman & Newfield, Box 959, Salisbury.
Cloud...	G. Friesland	3 years	8408.50	274.54	3.27	300	
Katie	G. Friesland	Mature	6897.00	242.99	3.52	300	
Pillow...	G. Friesland	Mature	7025.00	238.40	3.39	300	
Zambesi	G. Friesland	Mature	7066 00	259.79	3.68	300	
No. 125	G. Red Poll	Mature	6607.00	248.78	3.76	296	A. M. Tredgold, P.B. 61L, Bulawayo.
No. 68...	G. Red Poll	Mature	5857.00	240 72	4.11	300	
Cressydale Topaz	P. Red Poll	Mature	8790.50	321.08	3.65	300	
No. 147	G. Red Poll	Mature	7526.00	260.02	3.45	300	
No. L.14	G. Red Poll	Mature	7668.00	314 76	4.10	300	
No. 78	G. Red Poll	Mature	7816.00	299.60	3.83	300	
No. 144	G. Red Poll	Mature	6577.00	308.51	4.69	300	
Jenny	G. Red Poll	4 years	5823.00	238.27	4.00	300	N. W. Whitehead, Lonsdale Farm, Matopos.

Cleanliness Aids Insect Control

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INDEX.

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ERRATUM.

P. 158, May/June R.A.J., 8th line, "or 50 adult" should read "or 135 adult."